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OSTEOMYELITIS OF THE FRONTAL BONE

REPORT OF EIGHT CASES

RICHMOND McKINNEY, M.D.

MEMPHIS, TENN.

For several years an increasing amount of attention has been given to osteomyelitis originating in the frontal sinuses and extending to the frontal bone, with a growing recognition of the clinical importance of this condition.

The following notes and conclusions are deducted from observations made on a series of patients coming to the charity service of the John Gaston Hospital in Memphis. The surgical work was done largely by my associate Dr. Charles K. Lewis, of the department of otolaryngology of the University of Tennessee College of Medicine, and the pathologic study by Dr. Leo Harris, of the laboratory of that institution.

Although one writer, Woodward, concluded that osteomyelitis as a complication of frontal sinusitis is comparatively rare and that no one has reported more than 3 cases occurring under his personal observation,[1] my observation has been that in the majority of cases of osteomyelitis of the frontal bone the frontal sinuses have been the source.

In our service at the John Gaston Hospital there have occurred during the past two years not less than 12 cases of osteomyelitis of the frontal bone. The histories of 8 cases are presented here, and in several of these cases the frontal sinuses definitely were the point of origin. Frequently, traumatism of a sinus is an active factor in producing the disease.

The patients ranged in ages from 13 to 40, thus bearing out the assertion that since this is a condition involving the diploe, the more marked development of this tissue during adolescence and young adult life is largely instrumental for the greater incidence of osteomyelitis in the period before middle life.

Read at the Sixtieth Annual Congress of the American Laryngological Association, Atlantic City, N. J., May 4, 1938.

1. Woodward, F. D.: Osteomyelitis of the Skull: Report of Cases Occurring as the Result of Frontal Sinus Infection with Staphylococcus Pyogenes-Aureus, J. A. M. A. **95**:927-930 (Sept. 27) 1930.

The pathologic picture of this condition has been so thoroughly presented by Mosher and Judd [2] and various others, especially by Mosher, that it scarcely is necessary to go into this in the present report of cases. Suffice it to say that the infection found in most of our cases was predominantly staphylococcic, although other bacterial organisms may have been present. This infection, as is well known, extends by the diploic veins, with localized abscesses in the bone marrow.

The symptoms are clearly defined, for usually edema and frequently redness extend from the orbital ridge to the hair line rather quickly, and there is a low grade septic rise in temperature, although the patient may be free from fever. In only 2 of our cases, however, was there a definite leukocytosis.

The diagnosis in a number of the reported cases has been made on the basis of the clinical symptoms alone, without microscopic evidence of pathologic changes in sections of bone, but doubtless osseous changes were present, as the clinical findings were so definite.

I am of the opinion that this condition occurs much more frequently than would be judged from the number of cases reported and that in some cases in which the diagnosis is merely chronic frontal sinusitis the infection is in reality complicated by osteomyelitis.

This is an insidious disease, and unless of the fulminating type, in which development of the process is rapid, the amount of involvement of bone found at operation may be surprising. One of our patients was subjected to three operations before we were convinced that all of the diseased bone was removed.

While extensive removal of the frontal bone, including the inner table, may be necessary, the dura rapidly becomes covered by granulations, and the soft tissues thicken and afford ample protection to the brain. We have not observed our patients who were operated on long enough to note the regeneration of bone seen by Furstenberg,[3] but doubtless a certain amount of regeneration does definitely occur in the younger patients during the course of years.

In operating on these patients we have not followed any definite procedure but mainly have sought to remove all of the diseased bone, which can be done only by thoroughly reflecting the soft tissues covering the frontal bone and then biting and chiseling the cheesy bone away until what is judged to be normal bone is encountered. The amount of bone to be removed at times is appalling, but without thorough removal, operation is useless. Roentgenograms are useful as guides but are occasionally misleading, as bone macroscopically apparently in good condition is sometimes undergoing osteomyelitic changes.

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2. Mosher, H. P., and Judd, D. K.: Laryngoscope **43**:153-212 (March) 1933.
3. Furstenberg, A. C.: Tr. Am. Laryng., Rhin. & Otol. Soc. **36**:434-439, 1930.

The mortality rate in our series was about the same as that reported by others; 3 of the 8 patients died, 1 of meningitis, another from abscess of the brain and another from a concurrent bronchopneumonia. Lewis [4] found the mortality rate much higher after an operation on a sinus, in which conclusion I must concur.

The treatment is essentially surgical, prompt and thorough, in order to avoid possible, indeed probable, leptomeningitis, abscess of the brain or thrombophlebitis.

With these brief introductory remarks, I shall report, more or less in abstract, owing to their large number, the cases comprising this series. Three of the most interesting are given in detail. Complete records, with roentgenograms, the report on the blood chemistry and other details are in the hospital files but could not be given other than synoptically.

REPORT OF CASES

CASE 1.—W. K., a white boy 13 years of age, was admitted to the Isolation Hospital on Nov. 2, 1936, with a diagnosis of erysipelas. This provisional diagnosis was made because there were redness and swelling of one side of the face, extending from the supraorbital arch to the hair roots, which had been present for several days prior to admission. Roentgenograms showed extensive involvement of the ethmoid cells and also involvement of the frontal sinus on that side. Immediately, the ethmoid cells of this side were drained with the patient under general anesthesia, but in a short while pansinusitis developed, and the frontal and ethmoid sinuses were then drained. The frontal bone was found to be soft and bluish, typically osteomyelitic in appearance. The child, being diabetic, had little resistance, and three days later meningitis developed, which brought death on December 7. The white blood cell count just before the first operation was 8,520.

This case was undoubtedly one of fulminating osteomyelitis beginning in the ethmoid cells. Owing to the child's general condition, I doubt very much indeed if treatment, however radical and early, would have been of any value in preventing the fatal termination.

CASE 2.—B. L., a Negro aged 40, was admitted to the hospital on Dec. 29, 1936, with the history that he was struck over the glabella with a cotton scale six weeks before admission. His temperature averaged around 101 F. when he was admitted to the hospital, and he was poorly developed and poorly nourished. Roentgenograms showed what was apparently osteomyelitis of the frontal bone, nasal bone and ethmoid cells. The white blood cell count was rather low, being 3,650.

On December 31 the patient was given ether, and an incision was made along the right eyebrow down to the bone. The periosteum of the right frontal sinus was elevated, and a piece of necrotic bone was removed, pus and granulation tissue being curetted from the frontal sinus down to and including the nasal bone and the nasal process of the maxilla. This was removed, and the wound was packed with iodoform gauze.

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4. Lewis, C. K.: Memphis M. J. **13**:27-29 (Feb.) 1938.

On Jan. 7, 1937, there apparently being more involvement of the bone, the previous incision was reopened after anesthetization with procaine hydrochloride, and the discoloration of the bone was found to extend farther toward the floor of the frontal sinus and over the bridge of the nose. The discolored bone was removed, and a quantity of granulations and necrotic bone was cleaned out of the ethmoid capsule. On January 19, since the wound was not healing as satisfactorily as was expected, it was reopened, the anesthetic being administered intratracheally this time, and the edges of the bone previously exposed were found to be in good condition with the exception of a small area over the bridge of the nose. This was removed, and from that time on the man had an uninterrupted convalescence.

The pathologic laboratory reported that the sections of bone showed chronic osteomyelitis.

This case is interesting in that it showed that failure to remove even the smallest portion of diseased bone when there are osteomyelitic changes may continue to give rise to unfavorable symptoms. Further, it may be of some interest to note that three different kinds of anesthetic were used for the three different operations, for no especial reason, however.

Case 3.—W. H., a Negro 23 years of age, was admitted to the hospital with the history of swelling and inflammation in the right eye for three or four days before admission, which he thought were due to a cold in the head. Cellulitis was present in the right eye; the temperature ranged from 101 to 102 F.; the leukocyte count was 13,600, and the patient appeared toxic. There was decided tenderness over the right frontal bone. Roentgenograms showed increased density of the right antrum and right ethmoid cells, apparently due to the presence of fluid.

The next day, with the patient under nitrous oxide and ether anesthesia, the bone over the right frontal sinus was removed, and a quantity of foul-smelling pus was liberated. The ethmoid sinuses were opened, and the bone was found to be necrotic. Bluish, soft bone above the right orbit was extensively removed. The patient was later discharged to the outpatient department and in a short while was discharged as cured.

The bone removed was not examined by the pathologic laboratory, but it had the typical appearance of osteomyelitic bone.

Case 4.— T. M., a Negro aged 22, was admitted to the hospital in February 1937. He stated that he had been struck over the left eye seven months before, after which a swelling developed, which ruptured, leaving a fistula discharging thick creamy pus. There was no fever. His leukocyte count was 9,450. On the basis of a roentgen examination the diagnosis of chronic unilateral pansinusitis, with present activity, was made.

With the patient under colonic anesthesia, the right frontal sinus was opened, and the bone surrounding the fistula was found to be necrotic. This was removed, and the sinus was cleaned of pus and granulations. The pus showed a growth of Staphylococcus aureus of the hemolytic type. The laboratory reported that the specimens of bone removed revealed chronic osteomyelitis.

The wound continued to drain, and the patient returned to the hospital for reoperation on two occasions. The last time, in October 1937, roentgenograms showed some cloudiness of the frontal sinus but no extension of the osteomyelitis. Anesthesia was induced intratracheally this time, and the old incision was

reopened. The disease of the bone was found to be progressing not only along the cut edges of the bone but over the right frontal sinus and well up on the frontal bone in the midline. The bone showed the characteristic discoloration and moth-eaten appearance of osteomyelitis.

All bone that appeared to be diseased was removed, the resection being carried back into the bone around this area in an effort to remove all traces of osteomyelitis. The dura was covered by granulation tissue. The denuded field was painted with iodine, the dura was covered with a greased iodoform pack, and the scalp was closed, as is usually done at operation in cases of this character. Skin clips were used on the edges of the scalp to control bleeding.

Postoperative treatment, besides the usual irrigations with saline solution and the administration of sedatives, consisted of the administration of large doses of sulfanilamide and two transfusions of blood. The man was discharged a month after admission, with only a small gap between the eyebrows still open. When seen over three months afterward, he was free from any further symptoms of osteomyelitis. At this time he was cautioned to come into the outpatient department every day for dressing. This he failed to do, and after about three months he presented himself at the office in a serious condition. He had gone to Mississippi, where he was working, and had permitted the wound to close too quickly, with the result that an epidural accumulation of pus developed. He was immediately sent to the hospital, where an effort was made to save his life by establishing drainage, but in a short while he died from toxemia.

CASE 5.—H. M., a Negro aged 19, was admitted to the hospital in September 1936, with a complaint of purulent discharge from the right eye with swelling of the lid of two days' duration. Roentgenograms made on his admission showed marked cloudiness of the right ethmoid cells with only moderate involvement of the other corresponding accessory sinuses. Through an external opening the ethmoid cells were drained of a thick white pus. Shortly afterward, the patient was discharged, apparently much improved, and was instructed to return to the outpatient department, where he could be kept under observation pending subsidence of the acute symptoms. Two months later he was readmitted to the hospital, the incision not having healed; there was a small fistula, from which pus was draining. There was no pain or fever, and his general condition was good.

With the patient under colonic ether anesthesia, the old incision was reopened and enlarged, and the bone covering the right frontal sinus and ethmoid cells was found to be necrotic, with pus in the frontal bone. Resection of this bone was carried up to what was apparently healthy tissue, and the man was discharged on March 9, 1937. Since then, so far as is known, there has been no recurrence. The laboratory diagnosis was chronic osteomyelitis.

CASE 6.—M. H., a Negro aged 25, was admitted to the hospital on Sept. 25, 1937, with pansinusitis of the left side and spontaneous rupture of the corresponding frontal sinus; he also had bronchopneumonia. About two weeks before his admission headache and pain in the left eye developed; the eye began to swell and became inflamed, discharging a purulent material. The patient had some fever and light rigors, all of which increased in severity up to the day of his admission. There was a leukocyte count of 13,200.

An external incision was made, and the frontal bone was exposed. This was found to be necrotic, bluish and cheesy, and thick pus was evacuated from the frontal sinus and ethmoid cells of this side. The patient's condition would not admit of further operative treatment, and he was returned to the ward for observation. The temperature continued to follow a septic course, and a blood culture on March 10 was reported positive for Streptococcus haemolyticus. This

septic condition, together with bronchopneumonia, which the patient had at the time of admission, was responsible for his death on March 16. The bone removed showed chronic osteomyelitis.

Fig. 1.—Photomicrograph showing spaces of bony absorption (*1*) in which degenerated bone cells are visible; also irregular haziness of osteoid tissue, denoting a destructive process. Osteoblastic activity in the margins of bone is indicated by *2* and chronic inflammatory cell infiltration by *3*.

Case 7.—M. H., a Negress aged 39, entered the hospital complaining of pain and tenderness over the eye and forehead of one year's duration. These symptoms increased in severity, until they were almost unbearable. She ascribed the origin of this trouble to an acute cold in the head.

Edema and tenderness were found over both supraorbital regions, extending upward to the hair line. Roentgenograms of the bone underlying this area showed it to have a moth-eaten appearance. The temperature was 100 F. and the total white cell count 9,400.

Fig. 2.—Photomicrograph showing osteoblastic activity in the margins of bone (*2*), with regeneration of bone. Spaces of bony absorption are indicated by *1* and chronic inflammatory cell infiltration by *3*.

Anesthetization was obtained with avertin and procaine hydrochloride, and an incision was made supraorbitally. This was bisected by a vertical incision extending up beyond the edematous area, forming two triangular flaps. When the flaps

were retracted, the bone was found to be dark purple and necrotic. A triangular section of the bone was removed, and with it a fragment of dura about the size of a 5 cent piece. The dura was discolored and bled freely, but there was no indication of abscess formation. Because of loss of blood and the uncertainty

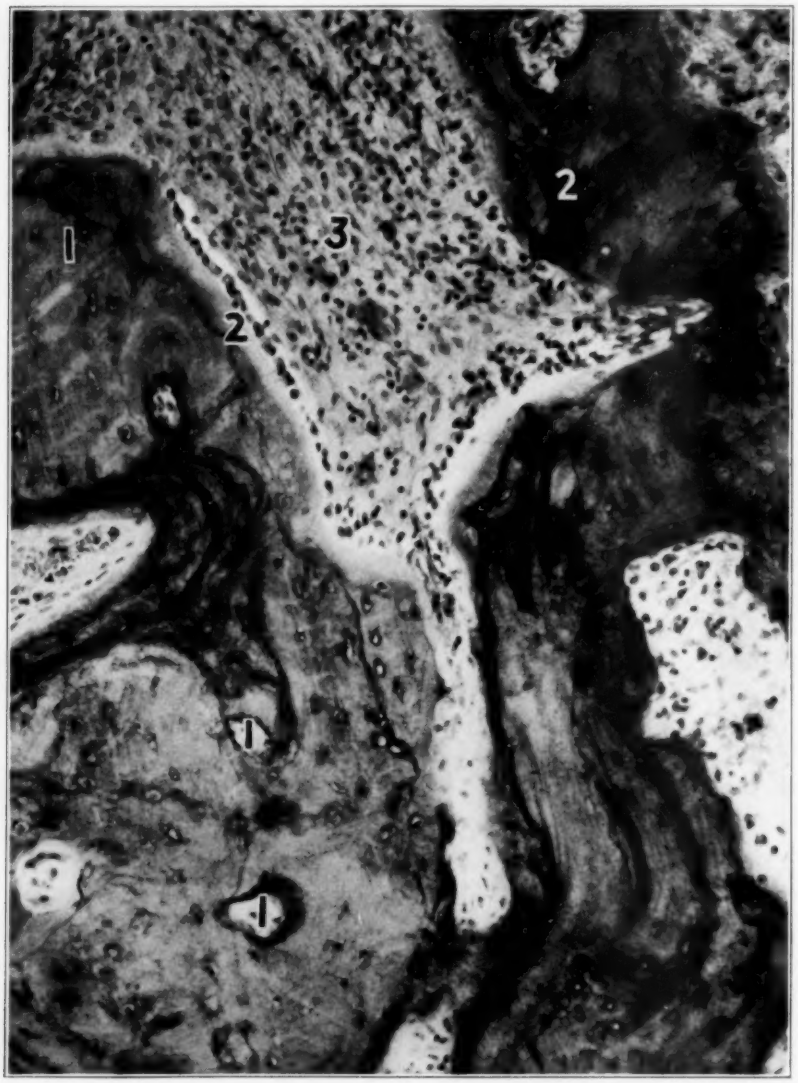

Fig. 3.—Photomicrograph showing chronic inflammatory cell infiltration (*3*) characterized by a few polymorphonuclear leukocytes, plasma cells and many lymphocytes. In addition, a desmoplastic reaction is noted. Spaces of bony absorption are indicated by *1* and osteoblastic activity in the margins of bone by *2*.

of blood donors for a transfusion, it was decided to postpone the completion of the operation until later. The laboratory reported that the bone showed chronic osteomyelitis.

After a week's interval, during which the patient received 550 cc. of blood intravenously, avertin was administered, and the incision was reopened. The remainder of the diseased bone was removed, with enough of the normal bone to insure a reasonable margin of safety. Iodine was painted over the dura and bone; a greased iodoform pack was placed over the dura, and drains were inserted. The edges of the scalp were then pulled loosely together to prevent retraction. The postoperative treatment consisted of the administration of large doses of sulfanilamide, irrigation of the wound with physiologic solution of sodium chloride and another transfusion. Convalescence was uneventful, and four months after operation there was found no sign of an active pathologic process.

CASE 8.—M. R., a Negress aged 22, was admitted to the hospital complaining of a severe pain over the right antrum and eye, with headache, fever and regular chilly sensation for the past three weeks. There was periorbital edema of the right eye and cheek, with extension of the edema toward the hair line of the corresponding side. There was a white blood cell count of 17,900. According to the roentgenographic report, there was chronic pansinusitis with fluid in the right antrum, and the right frontal bone appeared osteomyelitic.

An external frontal resection was done, with removal of the bone high on this side. The patient was discharged from the hospital a number of days later but returned in about a week with extension of the inflammation upward from the right frontal sinus.

With the patient under intratracheal anesthesia, the right frontal sinus, the ethmoid sinuses and the antrum were again cleaned out, and cheesy bone was removed for some distance above the right frontal sinus. This was found to be osteomyelitic. When the patient was seen a number of months later, she was free from symptoms and appeared to be entirely well.

899 Madison Avenue.

PREOPERATIVE MANAGEMENT OF ACUTE STREPTOCOCCIC MASTOIDITIS

E. MILES ATKINSON, M.D., F.R.C.S. (Eng.)
NEW YORK

When Ambroise Paré said that he dressed the wounds but God healed them, he was enunciating in the metaphysical manner of his age a physiologic fact of profound importance. Without the presence in the body of those defensive and reparative mechanisms which come into action as the result of injury, whether mechanical or bacterial, the organism could not survive, but Paré alone of his age appreciated and acknowledged this fact. Four hundred years later we of the medical profession are scarcely less ignorant of what immunity actually is. Immune bodies, opsonins and the like, are, when all is said and done, only postulates to explain a pathologic theory, not proved facts, however much we may delude ourselves. Yet without this defense mechanism, whatever it may be, all our therapeutic skill and surgical technic would be unavailing. In the treatment of acute infections in particular we are dependent for success on its adequacy. Without such resistance, without response to invasion by a pathogenic organism, the patient must die, while the doctor stands impotently by.

In the days before Lister, when a surgical operation was a hazardous adventure for both patient and surgeon, the physician was content to await the localization of an infection, as made manifest by the presence of an abscess, in order that the minimum of surgical interference, with its attendant risks and pain, should be necessary. With the advent of anesthesia, the appreciation of antiseptic and aseptic principles and the improvement in surgical technic, the art of surgery leaped ahead and operations began to be undertaken which before were beyond contemplation. It must be almost unbelievable to the present generation of students that it was only in 1866 that Lister began to operate antiseptically in a cloud of carbolic acid spray, that the first successful operation for a tubal pregnancy was done by Lawson Tait in 1883, before which time the condition was regarded as invariably fatal, and that when in 1901 the coronation of Edward VII was postponed on account of acute appendicitis and Treves undertook to operate, all medicine held its breath at the risk of a royal laparotomy.

As time went on and experience accumulated, surgery was divested of its fear and operation came to be undertaken more readily and more easily, until one passed in the space of fifty years from an era virtually

asurgical to one of superabundance. Nowhere was this excess more in evidence than in the right iliac fossa, unless it was in the tonsillar region. Judgment gave way before dexterity. Not least was this the case in the treatment of acute infections. As a result to a great extent of the success of early operation in abdominal emergencies, and especially in the treatment of acute appendicitis, it became the custom to open areas of infection at an increasingly early stage, without thought for the underlying pathologic process. In cases of streptococcic infection of the finger, that lethal condition to which the medical profession is particularly liable, the area was widely incised, and extensive operations were performed on acutely inflamed bones at the earliest opportunity, regardless of the fact that immediate appendectomy depends for its success on removal of the entire infected organ with its contents. When this condition does not apply, when infection occurs in an organ which cannot be excised in its entirety, the arguments in favor of early surgical intervention fall to the ground. Then the function of therapy is to await and encourage localization of the infection and the formation of an abscess, which is to be incised for the sole purpose of giving exit to pus as and when it is formed. Premature surgical intervention before the formation of an abscess can do nothing but harm by opening fresh tissue spaces to infection and interfering with mechanisms of defense which have already come into play.[1]

In the mastoid region this argument applies with especial force. Here is a bony structure which cannot be excised—moreover, a structure which more often than not is widely pneumatized and whose air cells are directly continuous with other groups of air cells which honeycomb, to greater or lesser degree, the petrous portion of the temporal bone. Furthermore, its roof, a thin sheet of bone, is also the floor of the middle fossa of the skull and presents only a tenuous barrier to invasion of the cranial cavity. A virulent infection of the mastoid, then, is pregnant with danger. If ill timed intervention is allowed to interfere with the natural protective processes, infection may be widely spread, and with dire consequences. Exenteration of a mastoid process even of diploic type before localization has occurred opens up a large area of fresh and unprotected tissue through which direct invasion of the blood stream can take place. Infection, likewise, can pass through cells in the petrous portion of the temporal bone to the apex, there to produce an abscess or meningitis or both, or the meninges may be infected directly from the mastoid itself. These calamities are not mere speculative possibilities—they happen.

1. Handfield-Jones, R. M.: Infections of Fingers and Hand, Lancet **2**:833 (Oct. 10) 1936.

TYPE OF MASTOIDITIS

The type of mastoiditis with which these disasters are likely to be suffered is only too well known to otologists. It appears in the course of an epidemic of influenza, of infection of the upper respiratory tract or of a specific fever. The organism is nearly always a streptococcus of a virulent strain, usually hemolytic. The history is that of an acute illness, which may be improving when there is complaint of sudden earache and rise of temperature. The drum head, which in the early stages is injected only, rapidly becomes scarlet and edematous; if it is incised, a thin serous fluid teeming with organisms, usually hemolytic streptococci, exudes from the middle ear in small quantity. In twenty-four hours or so there is definite, increasing and extending tenderness of the mastoid, and the patient is alarmingly ill, with all the evidence of a severe intoxication—high temperature, rapid pulse, dry skin, furred tongue, extreme lassitude. In rare instances of a fulminating infection, invasion of the blood stream occurs apparently coincidentally with that of the ear and carries off the victim within two or three days, usually with meningitis. A patient of mine, a woman of 56, died within thirty-six hours of onset. She went to bed one night apparently well, having been nursing her son through influenza, and woke up in the night with earache; when seen by me a few hours later, she already had early signs of meningitis. She died next morning, overwhelmed by the infection, with not a flicker of reaction to it.

It is obvious that operation cannot avail in such a case, but probably every otologist has fallen at some time into the temptation to operate in the early stage of a less severe infection. If so, he has found an acutely inflamed bone which oozes profusely blood and a thin serous fluid full of organisms, but nowhere pus, nowhere a cavity, nowhere any sign of limitation—an uncharted sea of bleeding bone. If he is fortunate, there follows only a stormy ten days, but not infrequently septicemia ensues, from which the patient is lucky if he escapes with no worse than a fixation abscess in joint or pleura (chart 1).

The course of wisdom, however, is not to operate, which means that one will have to withstand the natural desire of anxious relatives for action. This stand not uncommonly requires considerable courage to maintain, for if an operation has been performed, even if the result was not successful, it is always thought that at least all was done that could be done, while if the face of the physician has been set inflexibly against operation and ultimately the outcome is fatal, doubt invariably creeps into the minds of the relatives as to the wisdom of the course adopted, and this doubt is not concealed. In these days a greater self confidence and a larger judgment are required to withhold operation

than to advise it. Nevertheless, I am convinced that such an attitude is right and that a serious complication has never been warded off in a case of streptococcic infection by premature surgical intervention. It may be objected that sometimes one's hand is forced by circumstances, such as threat of meningitis. I submit that the onset of the complication will only be hastened by intervention before the infection has been brought under control. Sir David Wilkie, of Edinburgh, referring to acute infection of the finger, put the matter succinctly. He said: "You only need three things when you are called to such a case—a Bier's bandage, a 40 cc. syringe full of antitoxic serum, and a cheerful countenance. You can leave your knife at home!"

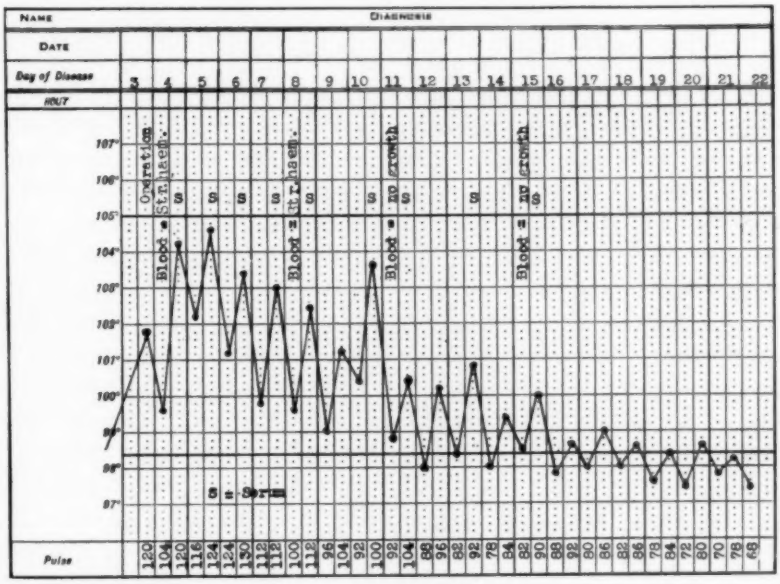

Chart 1.—Operation was performed on the third day of illness due to infection of the ear. The blood culture, unfortunately, was not made before, but was positive after, operation. Note (1) the sharp rise in temperature on the tenth day, after omission of serum on the ninth, and the slight rise on the thirteenth and fifteenth days, and (2) the still unsteady temperature at the end of the third week.

PREOPERATIVE MEASURES

General Measures.—If operation is denied, one does not therefore stand idle. Patients with mastoiditis are suffering, at the best, from bacteremia, if not active septicemia, and much can be done to help them collect their forces against the attack. In the first place, they are shocked by the sudden onslaught, shocked and anxious. They need physical and mental rest. Nothing can give that to them better than morphine. I am always at a loss to understand the prejudice which will

withhold the benefits of morphine from the many because of its abuse by the few. Paget, who once suffered from septicemia, paid a glowing tribute to this drug. Absolute rest in bed, then—not a hand's turn should the patient do for himself—preferably out of doors, and morphine, are the immediate desiderata. The diet is fluid, and extra fluid should be forced. If it cannot be taken by mouth in sufficient quantity it must be given by rectum, into the subcutaneous tissues, or by continuous intravenous drip. Local heat should be used to relieve pain and to increase the blood supply. It can be applied by the homely hot water bag, the electric pillow or a short wave apparatus.

Antitoxic Serum.—In addition to these general measures, more specific measures can be undertaken, and among these I have deliberately given pride of place to serum. Specific serum is used in streptococcic disease to a much greater extent in Europe than in America, though even there opinion is divided as to its efficacy. Lord Horder [2] and Sir David Wilkie, for instance, advocated its use; Professor Ryle [3] was unconvinced of its value. I believe that this was due partly to the variation at that time in the potency of different serums and partly to pusillanimous dosage. As for myself, I am a firm believer in serum. I have seen case after case in which the whole picture has changed after its administration—too many to be mere coincidence. I have records of cases in which the temperature dropped immediately after administration of serum and remained down, to rise when serum was stopped too soon and to fall again on its resumption (charts 1 and 2). There are, however, two essentials to the satisfactory use of serum. The first is that the serum must be polyvalent and of known potency, for serums vary much in this respect. The one I was accustomed to use in England, with excellent results, is unfortunately not obtainable in the United States, but the one [4] I have employed here has proved nearly as satisfactory; no doubt other serums are equally good. The second essential is that the dose must be adequate. Forty cubic centimeters given intravenously is not too much as the initial dose for an adult with a severe infection, and the sooner it is given the better. Administration of serum should be continued in doses of half that amount, given intramuscularly, at first daily and then every second day until the infection is brought under control. It is probably unnecessary to issue a warning against giving the first dose without previously determining whether the patient is sensitive, but the precaution is needed in these days when preventive

2. Horder, T.: Observations on the Treatment of Septicemia, Brit. M. J. **2**:594 (Oct. 3) 1931.

3. Ryle, J. A.: Natural History, Prognosis and Treatment of Streptococcal Fever, Guy's Hosp. Rep. **81**:1 (Jan.) 1931.

4. Prepared by Parke, Davis & Co., Detroit.

serums are so frequently used. Desensitization can be achieved, when necessary, in two hours.

Nucleinic Acid.—This drug is reputed to stimulate leukocytosis, and clinical experience endorses the claim.[2] I place it here not because it comes second in order of merit but because it can conveniently be given intramuscularly every second day, in alternation with serum. It is useful to add strychnine and sodium cacodylate for their tonic effects. A suitable prescription is:

Sodium cacodylate		0.03 Gm.
Solution of strychnine (B. P.).....		0.06 cc.
Nucleinic acid (saturated).....	to	1 cc.

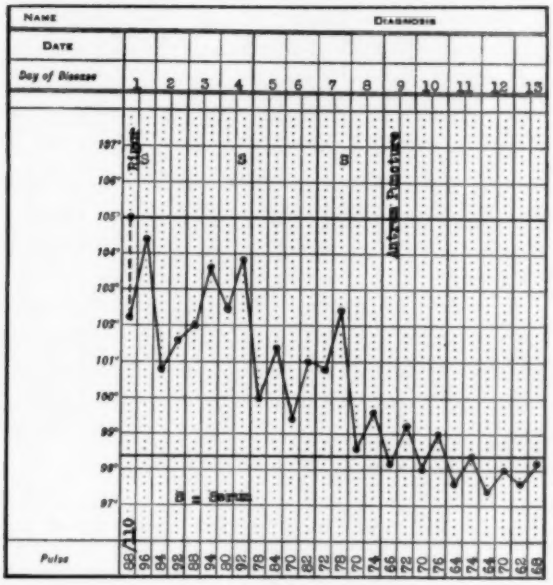

Chart 2.—Acute streptococcic pansinusitis arising during the course of scarlet fever, on the third day after appearance of the rash. The dose of serum was inadequate, but the chart shows well the reaction to serum on each occasion and settling of the temperature at a lower level. There was no operative treatment other than simple puncture of the antrum on the ninth day.

Blood Transfusion.—There is no need to sing the praises of this procedure here. Indeed, one would like to apply a brake, for one sees it used so frequently without discrimination. Transfusion is not a cure for all the ills that flesh is heir to, nor is it entirely without risk. As far as it concerns the present matter, the case may be put thus, that in the absence of a satisfactory serum, transfusion should be employed, and preferably an immunotransfusion. Ideally, blood from several donors should be tested for titer against the offending organism and

the serum with the highest titer selected. Failing that, any compatible blood will supply fresh leukocytes and antibodies which are of benefit, though its main effect is probably more that of helping the accompanying anemia than of combating the infection. The quantity given should be small, not more than 250 cc. for an adult, for it is not difficult to overload an acutely intoxicated heart.

Sulfanilamide and Allied Compounds.—This drug also needs no advocacy; it is suffering as it is from too good a press. Like transfusion, it is no panacea, but unfortunately, as a result of certain spectacular achievements and an initial social success, it has been used indiscriminately by and for all and sundry. Granted that it has had a number of dramatic successes and that in the realm of aural surgery it has altered entirely the outlook for hemolytic streptococcic meningitis,[5] yet it must be used with discretion and with due appreciation of its limitations. Thus, there is so far no convincing evidence that the drug is of value in combating any streptococcus that is not hemolytic. Further, in infections of the middle ear, even when the hemolytic type is the offender, the results so far have been disappointing, the reason for which may lie in the relative poverty of the blood supply to the middle and inner ear. Again, the drug is not without its dangers, although, unfortunately, it can be bought casually across the counter. Reports are increasing of cases in which agranulocytosis [6] and other forms of anemia [7] follow its use, and the liability to a marked decrease in the hemoglobin content of the blood is well known; so it is essential that examinations of the blood should be made at regular and frequent intervals during its administration. Nevertheless, there is no doubt that the drug is a useful addition to the physician's armamentarium, and it is to be hoped that it will not be killed, like others before it, by too much enthusiasm.

Shock Therapy.—Of how much justification there is for the artificial production of a fixation abscess by injection of turpentine I am not sure. I have had no personal experience with the procedure, but some favorable reports have been given. Certain it is that when nature performs the same function the outlook immediately improves, so that one has come to regard empyema or an infected joint as the turning of the tide, however unfortunate in other ways it may be. On these

5. Weinberg, M. H.; Mellon, R. R., and Shinn, L. E.: Two Cases of Streptococcic Meningitis Treated Successfully with Sulfanilamide and Prontosil, J. A. M. A. **108**:948 (June 5) 1937.

6. Young, C. J.: Agranulocytosis and Para-Amino-Benzene Sulphonamide, Brit. M. J. **2**:105 (July 17) 1937.

7. Harvey, A. M., and Janeway, C. A.: The Development of Acute Hemolytic Anemia During the Administration of Sulfanilamide (Para-Aminobenzenesulfonamide), J. A. M. A. **109**:12 (July 3) 1937.

grounds it would seem that shock therapy should have its uses but that it should be employed late in the disease.

SIGNS OF LOCALIZATION

Eventually, from about seven to ten days after the onset of the infection of the mastoid, a change begins to be apparent in the patient. He who previously has been apathetic and listless becomes bright and alert; the sallow skin becomes clear, the dull eye bright and the dry, furred tongue clean and moist. At the same time, the temperature falls from the 103 or 104 F. mark and begins to take on a swinging character,

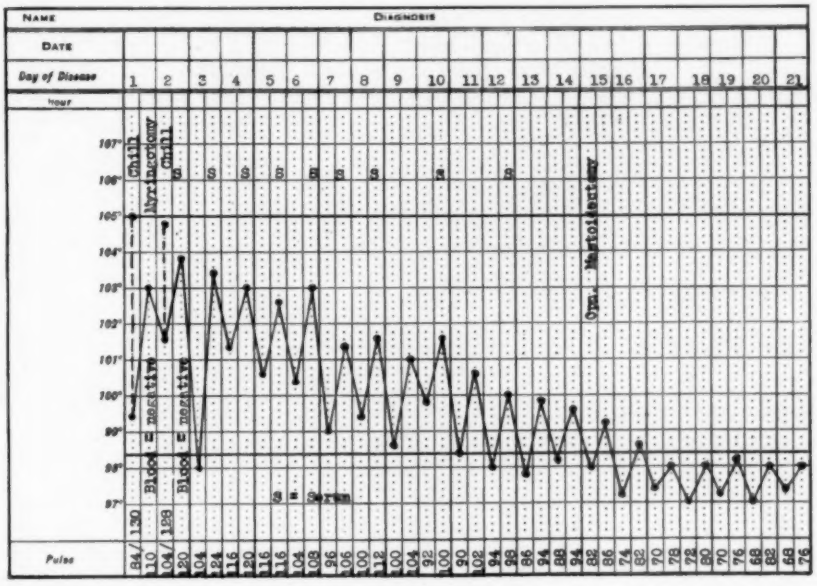

Chart 3.—Infection of the middle ear on the sixth day of illness arising during recovery from acute nasopharyngitis. Note the protein shock following intravenous injection of serum. Operation, which was not performed until the fifteenth day, revealed localized abscess of the mastoid. Note the absence of disturbance following operation.

being normal in the morning and 100 to 101 F. in the evening, while the pulse steadies. The blood picture, which possibly showed leukopenia at first, now shows leukocytosis, with a count of 20,000 or more, and the tenderness of the mastoid, which was diffuse, becomes more definitely localized. Still it pays not to be in a hurry. The changed clinical picture should be allowed to stabilize itself, and the temperature to settle or to take on a definite swinging character for two or three days, before operation is undertaken (chart 3). I have on occasion

delayed three weeks before operating. Operation then will reveal the presence of pus, probably localized in a cavity, in any event with the limits of its extent clearly defined; the postoperative course will be smooth and free from anxiety, and healing will take place rapidly.

RESULTS

It is difficult to speak of results because of the difficulty of accurate comparison. It is impossible to say that a certain patient would have died had operation not been performed immediately, any more than it is possible under opposite condition to maintain the reverse. In an attempt to get something concrete with which to support the view put forward

Results of Immediate and Delayed Operation in Two Groups of Patients with Acute Streptococcic Mastoiditis

	Operation	
	Immediate 1926-1931	Delayed 1932-1935
Total number of patients	19	14
Patients with meningitis	2 (both died)	0
Patients with petrositis (Gradenigo's syndrome)	3 (1 died)	1
Postoperative septicemia	3 (all had a fixation abscess and recovered)	0
Average number of days in hospital	33	27
Number of patients with complications	8	1
Number of deaths	3	0

in this paper, I went through my private records for the years from 1926 to 1935 inclusive and picked out the cases of mastoiditis which came into the category under discussion. There were 33 cases in all, and these I divided into two groups: one of 19 cases from 1926 to 1931 inclusive, the period when I was still under the influence of false teachings and operated immediately on all mastoids with obviously acute infection, and one of 14 cases from 1932 to 1935 inclusive, when I followed the lines I have advocated here. The results are shown in the accompanying table. It will be seen that of the 19 patients operated on without delay, 8 had complications, 3 of whom died, while of 14 patients treated expectantly only 1 had any complication and none died. There were infections of as great severity in the second group as in the first. Further, the average length of stay in the hospital for the first group was thirty-three days, and that for the second, only twenty-seven days.

SUMMARY

An argument is put forward for delay in operation in cases of acute streptococcic mastoiditis until localization of infection has occurred. Preoperative management and the indications for operation are discussed. The results of immediate and of delayed operation as they have appeared in my practice are presented in a table and show that when the expectant treatment is adopted there are fewer complications, a lower mortality and a shorter period of hospitalization.

570 Park Avenue.

OSTEOMA OF THE MASTOID PROCESS

STANTON A. FRIEDBERG, M.D.
CHICAGO

Of the bony tumors of the skull, those of the external auditory canal and of the accessory nasal sinuses are perhaps the most commonly encountered by the otolaryngologist. Osteoma of the mastoid process is infrequent in occurrence; Haymann [1] in 1919 was able to find but 8 authentic cases. Since that time, reports by Fränkel,[2] Bruzzi [3] and Breyre [4] have appeared. Because of this dearth of clinical material and the absence of any comparable data in the American literature, it was deemed advisable to record the following case.

REPORT OF A CASE

M. S., a Negress aged 52, came to the otolaryngologic clinic at Cook County Hospital early in December 1937 because of a hard mass behind the right ear, which had been slowly increasing in size for ten years (fig. 1). The patient recalled a severe blow by a fist on the involved area approximately two years prior to the initial appearance of the growth. There had been no symptoms other than the progressive enlargement of the tumor and occasional transitory mild pain in the affected region. There was no history of earache, aural suppuration or tinnitus. Occasional dizzy spells had occurred after an abdominal operation, but these were unaccompanied by nausea, headache or falling. Six years previously the patient began antisyphilitic therapy, which was continued for three years. Since the conclusion of this treatment frequent Wassermann tests of the blood, the last one in November 1937, had given negative reactions. No other member of the patient's family had been known to have any similar type of growth.

On examination, the teeth were found to be in excellent condition. There was a rounded bony mass on the hard palate at the intermaxillary and palatomaxillary suture (torus palatinus). Examination of the nasal passages and the pharynx gave essentially negative results. The accessory nasal sinuses were equally and clearly visualized on transillumination. There was no cervical adenopathy. Just

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Read before the Chicago Laryngological and Otological Society Feb. 7, 1938.

From the departments of otolaryngology, Cook County Hospital and Rush Medical College.

1. Haymann, D.: Zur Kenntnis der Knochengeschwülste des Warzenfortsatzes (Osteoma eburneum processus mastoidei), Ztschr. f. Ohrenh. **78**:23-32, 1919.

2. Fränkel, I.: Osteoma of the Mastoid, Ztschr. f. Hals-, Nasen- u. Ohrenh. **30**:623-626, 1932.

3. Bruzzi, B.: Osteoma of the Mastoid Apophysis, Boll. d. mal. d. orecchio, d. gola, d. naso **51**:263-266, 1933.

4. Breyre, C.: Osteoma of the Mastoid Apophysis, Liége méd. **28**:557-558, 1935.

posterior to the right auricle and overlying the entire mastoid process, except the tip, there was a round, smooth, immobile bony mass measuring 4 by 3 by 1.5 cm. The auricle was displaced anteriorly, and the external auditory canal was slightly narrowed. The right tympanic membrane was unchanged. The left ear was normal in all respects. Functional testing of the cochlear and the vestibular system gave entirely normal results. Complete physical examination failed to disclose any other bony tumors.

Fig. 1.—Osteoma of the right mastoid process, with slight anterior displacement of the auricle.

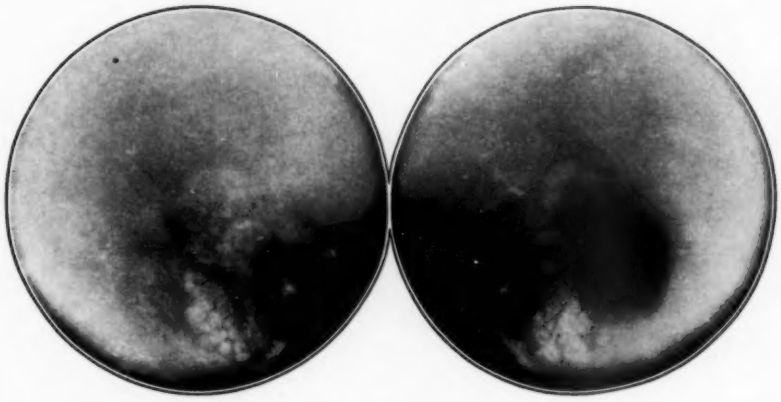

Fig. 2.—Osteoma overlying the posterior-superior portion of the right mastoid process.

Urinalysis and two Wassermann tests of the blood gave negative results. Determination of the blood calcium showed 11.2 mg. per hundred cubic centimeters. Roentgenograms showed a pneumatized mastoid process with a dense opaque shadow in the posterior-superior portion, which was thought to be an osteoma (fig. 2). Roentgenograms of the accessory sinuses, taken subsequently, showed no abnormalities.

At operation, performed with nitrous oxide anesthesia by Dr. L. T. Curry, the usual mastoidectomy incision was employed. The tumor was covered by a layer of periosteum, which was easily separated. The mass was firmly attached

to the cortex of the mastoid, and the upper portion overlay the remnant of the squamomastoid suture. Removal was begun with a gouge. After several small chips of bone had been cut away, the entire tumor was cleanly dislodged from the underlying cortex, which was seen to be intact though slightly roughened. The skin and periosteum were closed with silkworm mattress sutures, and a gutta-percha drain was inserted. Healing of the wound was uneventful.

Pathologic Examination.—Gross: The specimen was a hemispherical bony tumor measuring 3 by 2.5 by 1.5 cm. The surface was smooth everywhere except on the posterior margin (where bone had been surgically removed) and on the slightly concave medial aspect, which marked its attachment to the mastoid cortex (fig. 3). In the latter region there was a small localized adherent layer of periosteum measuring 1 cm. in length and 1.5 mm. in depth. After partial decalcification in 10 per cent nitric acid, the tumor weighed 9 Gm. A surface made by cutting through the mass revealed a homogeneous and uniformly compact white, ivory-like structure.

Fig. 3.—Osteoma of the mastoid process after surgical removal. The anterior and the concave medial surface are shown, the latter being the site of attachment to the mastoid process. This area appears darker on the specimen, and on it a longitudinal strip of thickened isolated periosteum can be seen.

Microscopic: In sections of the tumor stained with hematoxylin and eosin, the osseous structure was of the mature compact type (fig. 4). The haversian systems were surrounded by regular, concentric lamellae. The majority of the lumens were small, and in several regions the canals contained a fibrillar structure which by its distribution suggested the presence of fat cells; no evidence of osteoblastic activity was apparent.

ETIOLOGY

Constitutional factors and diatheses were formerly thought to be of significance in the etiology of this condition, although Haymann [1] was unable to establish any causal relationships between osteoma and rheumatism, gout or syphilis in the cases which he carefully analyzed. In this connection, the history of syphilis in the present case is perhaps worthy of reconsideration despite the fact that antisyphilitic treatment

apparently had no retarding effect on the growth. A possible disturbance of calcium metabolism was brought to mind by the associated palatal osteoma, but the blood calcium content was within the range of normal. The more frequent occurrence of these tumors in females and their appearance only after puberty have been generally recognized as sig-

Fig. 4.—Section of compact bony tissue from the tumor, stained with hematoxylin and eosin.

nificant. A hereditary tendency has been described in relation to multiple exostoses.

Trauma with subsequent ossifying periostitis doubtless serves as a predisposing influence in some instances, while in others injury may appear to be the actual exciting cause. In the case under discussion, several points might justifiably cast doubt on the traumatic origin of

the tumor: first, the concomitant presence of the palatal neoplasm; second, the well known tendency on the part of patients to attribute their condition to some previous incident, and, finally, the fact that the injury antedated the appearance of the growth by at least two years.

A chronic inflammatory process has doubtless been the underlying agent in some cases. An osteoma of the mastoid process described by Vandervoot [5] occurred in a patient with chronic suppurative otitis media of forty years' duration. A similar description has been offered by Körösi.[6] Germán [7] reported the accidental discovery of twelve small bony tumors within the mastoid process during an operation for chronic otitis media. There is no evidence that disease of the middle ear played any role in this case.

Finally, it should be remembered that the appearance of the tumor may be unattended by any assignable cause.

PATHOLOGY

According to Ewing,[8] "Circumscribed overgrowth of bone occurs under such a wide variety of conditions, and the distinctions between inflammatory and neoplastic hyperplasia of the tissue are so often obscure, that it has never been possible to exactly define the limits of osteoma." Osseous tumors of two different types occur in the temporal bone: First, large tumors located in the mastoid process and seldom in the squama, and, second, smaller tumors located superficially in the os tympanicum.[9] In the latter group belong the well known exostoses of the external canal.

Bony tumors of the mastoid process usually occur singly, project in rounded fashion from the surface and occasionally encroach somewhat on the lumen of the external meatus. Their size may be considerable, as in Weinlechner's [10] case, in which the growth weighed 30 Gm. When the tumor has its origin in the substance of the bone itself and grows centrally rather than peripherally, it may be described as enostosis (Vir-

5. Vandervoot, cited by Buck, A. H.: Diseases of the Mastoid Process: Their Diagnosis, Pathology, and Treatment, translated, Arch. f. Augen- u. Ohrenh. **3**:1, 1874.

6. Körösi, cited by Fränkel.[2]

7. Germán, T.: Multiple Small Bony Tumors in the Mastoid Process, Ztschr. f. Hals-, Nasen- u. Ohrenh. **18**:339-349, 1927.

8. Ewing, J.: Neoplastic Diseases, ed. 3, Philadelphia, W. B. Saunders Company, 1934, p. 213.

9. Henke, F., and Lubarsch, O.: Handbuch der speziellen Pathologie und Histologie, Berlin, Julius Springer, 1926, vol. 12, pp. 498-500.

10. Weinlechner, J.: Osteoma of the Mastoid, Monatschr. f. Ohrenh. **20**:341-343, 1886.

chow). Kretschmann [11] emphasized the importance of suture lines in the skull as sites of predilection. In a report concerning the development of an osteoma at the parietosquamooccipital juncture, this author proposed an analogy between sutures in the skull (particularly in the region of the fontanels) and the epiphyses of long bones, thereby attempting to establish a relationship between the types of exostoses in the respective areas. In passing, it might be mentioned that such a theory deserves consideration, as it offers an explanation for the topography of the tumors, for their appearance after puberty and for the hitherto unexplained occurrence of osteomas of the nasal accessory sinuses.

Grossly these tumors are composed of homogeneous ivory-like bone. Microscopically the tissue consists of compact bone with solid lamellae and sparse haversian canals. The term osteoma eburneum most accurately describes the structure. Occasionally cancellous tissue or marrow spaces predominate. These variations may be regarded as yielding some clue as to the origin of the growth. In Kretschmann's case, the tumor exhibited a fibrous stroma in which were embedded multiple minute structures consisting of lamellated bony substance. The term osteoma conglomeratum was suggested. The origin was in all probability the periosteum, and the lesion was probably an ossified fibroma.

To quote again from Ewing: [8]

> Histological study fails, as a rule, to distinguish simple hyperplastic bone from true osteomas. When originating in bone both processes show a participation of some or many osteoblasts which surround the edges of the new growth and add to its substance from one or many sides. Both processes yield dense lamellated bone with few Haversian canals or spongy bone with many vessels and abundant narrow spaces and cells. . . . The gross and clinical features seem to form the best criteria by which to separate osteoma from simple hyperostosis.

SYMPTOMATOLOGY

The typical osteoma of the mastoid process produces no symptoms. Occasionally there may be pain or tenderness on pressure, particularly if extension medially involves the inner table of the skull. Obstruction of the auditory canal may result in impaired hearing, a symptom which would also occur in association with a suppurative process in the middle ear.[12] Bruzzi's [3] patient lamented the disturbance created by the bony proturberance to the nun's headgear which she wore. Cooper's [13] patient was "very desirous of having it removed in consequence of its interference with her bonnet strings."

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11. Kretschmann: Osteoma of the Skull Bones, Verhandl. d. deutsch. otol. Gesellsch. Dresden, 1910, p. 305.

12. Burger, H.: Inner Osteoma of the Mastoid, Monatschr. f. Ohrenh. **65**: 1447-1450, 1931.

13. Clinical Records, Lancet **1**:628, 1861.

DIAGNOSIS

The diagnosis is not difficult if the examiner is aware of the infrequent occurrence of such tumors. Roentgenograms may establish the true nature of the neoplasm or, as exemplified by Claus's case, be responsible for its discovery.[14] Whether the status is benign or malignant should be determined. Retroauricular cysts would not be expected to cause any diagnostic uncertainty.

TREATMENT

Surgical removal of osteoma of the mastoid process is indicated when distressing symptoms accompany the growth of the tumor or for cosmetic reasons. Otherwise, the usual benign character of the growth may be explained to the patient and its presence disregarded.

SUMMARY AND CONCLUSIONS

Osteoma of the mastoid process is rare.

A case is reported in which the tumor was associated with a comparable growth on the hard palate.

Frequently, as in the case of most neoplasms, no definite cause can be ascertained, although trauma or chronic inflammation may be a predisposing agent.

The tumor is usually benign. It is composed of compact bone, and the differentiation between simple hyperplasia and true osteoma may be difficult.

The symptoms are often negligible, and surgical removal, when indicated, offers practically no difficulty.

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14. Claus, G.: Exostoses in Accessory Sinuses and Mastoid Cells, Ztschr. f. Hals-, Nasen- u. Ohrenh. **22**:223-227, 1929.

OSTEOMA GROWING FROM THE MASTOID CORTEX

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Osteoma in the region of the mastoid is believed to be a rarity. It can be classified as a true osteoma, or bony neoplasm, rather than as an exostosis or hyperostosis. The osteoma seen by the otolaryngologist is usually in the lumen of the frontal sinus or in the ethmoid capsule. A hurried and incomplete search of the literature and personal communications from a number of pathologists and otologists confirm the impression that few reports of similar growths in the region of the mastoid cells have been made.

REPORT OF A CASE

J. K., aged 39, an executive in an insurance company, in 1927 had his attention called by his barber to a painless swelling on the left side of the head, behind the ear and just within the hair line. He was unable to associate any trauma with this growth, there was no pain and the skin over the mass was freely movable. As the tumor did not subside but seemed to grow slowly larger, he consulted Dr. J. Gershon-Cohen, a prominent roentgenologist. Dr. Gershon-Cohen took roentgenograms of the head in 1932 and reported that a small hard bony tumor, about 1.5 cm. in diameter, was located at the superior-posterior angle of the left mastoid. It sprang from the outer table, was well circumscribed and extended into the diploe but was not invasive. The right mastoid was well developed and normal; the left mastoid was not so well pneumatized as the right. The lateral sinus stood out more clearly on the left side and faded completely from view just at the site of the bony tumor.

A roentgenogram taken April 6 showed an osteoma on the left mastoid just at the upper posterior course of the pneumatic portion. It sprang from the outer table, was uniformly calcified and measured about 1.5 cm. in diameter.

The patient was referred to me on June 6, 1932, when the growth presented the appearance described. On August 6 he complained of slight pain on the left side of the head and was somewhat apprehensive of possible malignancy. The pain soon subsided, and he was not seen again until June 19, 1936, at which time, as the growth was appreciably larger and worried him by its mere presence, it was decided to remove it surgically. This was done in the Graduate Hospital of the University of Pennsylvania on June 23, with tribromethanol anesthesia. An incision was made directly over the mass, from which the skin and the periosteum were elevated fairly easily. A flat chisel was placed at the junction of the tumor with the cortex, and three light blows of the mallet partially separated the tumor from the skull; it was then pried loose with the chisel and came away easily, leaving the hard outer table of the skull smooth and with nearly its normal contour. The

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Read before the Section on Otolaryngology of the College of Physicians of Philadelphia, Nov. 18, 1936.

mass was almost circular and measured about 1½ inches (3.8 cm.) in diameter by ½ inch (1.3 cm.) in thickness, being slightly concave at its attachment. It was hard bone but not of the solid, ivory-like consistency of the osteomas usually seen in the sinuses. The wound was closed by skin clips without drainage and a pressure bandage applied. There was no pain or inflammatory reaction after the operation except in the membrana tympani, which became congested and caused mild earache. This subsided in a few days, the clips were removed on the third day and the wound was healed and dressings dispensed with on the seventh. Since then there have been no symptoms and no return of the bony growth.

Roentgen examination by Dr. Gershon-Cohen on August 17 (eight weeks after the operation) showed the bone to be healthy.

The pathologic report by Dr. Eugene Case, of the Graduate Hospital, was as follows: "The tissue shows compact bone, with small marrow spaces filled with fibrillar connective tissue. There is no fat in these spaces. The diagnosis is osteoma."

At one time I thought that the tumor might have invaded or have originated in the pneumatic spaces of the mastoid, but this was not the case; it was entirely external. Unfortunately the specimen was lost in the laboratory, so that a photograph of it cannot be presented. The patient today presents nothing of interest except a hardly distinguishable linear scar within the hair line.

PLASTIC REPAIR AFTER REMOVAL OF EXTENSIVE MALIGNANT TUMORS OF THE ANTRUM

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More effective therapy for malignant tumors of the antrum has produced additional responsibility for the surgeon, that is, the correction of the deformity that at times follows the removal of such a growth. Surgical treatment as a rule leaves no appreciable change in the facial contour provided the lesion has not extended beyond the sinus. However, when extrinsic involvement is present, therapy sufficiently radical to offer a possibility of curing the disease is likely to cause more or less marked deformity of the face. Although the patient may be freed from his malignant disease, he is often left so badly disfigured that he can neither mingle socially nor earn a livelihood. The rehabilitation of the patient, accordingly, is at times as important as curing him of his malignant tumor. Repair of the deformity often presents a major problem in plastic surgery.

Various forms of treatment have been used in dealing with malignant tumors of the maxillary sinus. The prognosis and the tendency to produce external deformity vary greatly with the different therapeutic measures. Resection of the superior maxilla or any of the other cutting operations which were commonly employed a few years ago only infrequently effected eradication when the tumor was confined within the antrum and rarely did so when it had become extrinsic. Moreover, such a procedure often caused considerable external deformity. Irradiation with radium alone or with radium and roentgen rays combined at times produces striking results in cases of a highly malignant tumor in this situation, and a minimal change in the facial contour is likely to follow. The combination of electrocoagulation or actual cautery and irradiation has, however, proved most effective in the hands of the majority of surgeons interested in this field. This type of therapy has been used in dealing with these tumors at the Mayo Clinic since 1917.[1] An opening is made into the antrum through the buccal fold or, if the

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From the Section on Laryngology, Oral and Plastic Surgery of the Mayo Clinic.

Read at the Sixtieth Annual Congress of the American Laryngological Association, Atlantic City, N. J., May 2, 1938.

1. New, G. B.: Treatment of Malignant Tumors of the Antrum, J. A. M. A. **74**:1296-1300 (May 8) 1920.

tumor is extrinsic, at the point elsewhere inside the mouth where it approaches nearest the mucosal surface. Usually, the exposure is made by means of electrocoagulation, and destruction of the tumor is effected in the same manner. At the completion of the operation radium is packed into the antrum, especially into those portions of the cavity where the thoroughness of the removal is questionable. With this type of treatment 40 per cent of five year cures have been secured in the cases of primary tumor of the antrum, and 53.4 per cent of five year cures have been secured in the cases in which the involvement of the sinus was secondary to a malignant tumor of the upper jaw.[2] In view of this relatively good prognosis it seems appropriate that serious consideration be given to the repair of deformities incident to the treatment of these tumors. The literature contains few references to their correction. The inference would seem to be that the patient and his physician have been content with arrest of the malignant process and have not taken cognizance of the functional and cosmetic aspects. The most detailed considerations on the repair of these deformities that I have been able to find have been that of Ohngren,[3] in his excellent monograph "Malignant Tumors of the Maxillo-Ethmoidal Region," and that of Beck and Guttman.[4]

Whether or not external deformity will result after removal of a malignant tumor of the antrum in this manner depends largely on the situation and the extent of extrinsic involvement. If the growth is limited to the sinus, no appreciable change in the contour of the face is likely to develop postoperatively even though the neoplasm completely fills the antral cavity and thorough cauterization of the entire bony wall is necessary. Maintenance of a large opening into the antrum is desirable in all cases in order to permit of inspection for possible recurrence for at least a year after the operation. This is insured in the usual case by wide electrocoagulation of the area of approach on the anterior antral wall. If the tumor has eroded through the bony palate or is causing bulging of the alveolar process and is situated directly beneath the mucous membrane of the mouth, in which event it is exposed at one of these points, the perforation will be in the corresponding situation. While an opening here is more bothersome to the patient than one through the anterior wall of the antrum, it is readily closed with a

2. New, G. B., and Figi, F. A.: Malignant Diseases of the Mouth, Pharynx and Larynx: Five-Year Cures, Surg., Gynec. & Obst. **60**:483-484 (Feb. 15) 1935.

3. Ohngren, L. G.: Malignant Tumors of the Maxillo-Ethmoidal Region, Acta oto-laryng. **19**:1-476, 1933.

4. Beck, J. C., and Guttman, M. R.: Plastic Repair of a Facial Defect Following Operative Treatment of Carcinoma of the Antrum and Upper Jaw, S. Clin. North America **14**:775-782 (Aug.) 1934.

special dental plate and accordingly is of no serious consequence. The most common external deformity is retraction and elevation of the upper lip and the angle of the mouth. This occurs not infrequently after removal of a primary tumor of the antrum that is entirely intrinsic. It is encountered more frequently, however, in cases in which the growth has perforated the anterior wall or the alveolar process and in cases in which the antrum is involved secondarily by a malignant neoplasm of the anterior part of the upper jaw. It is due to contraction of the scarring in the soft tissues overlying the anterior wall of the antrum and that resulting from loss of the mucous membrane in the labial sulcus and on the inner surface of the upper lip together with loss of the underlying bony support. Perforation externally through the cheek into the antrum is one of the most conspicuous deformities occurring in this connection. It is likely to develop only in cases in which the lesion has eroded through the anterior wall of the antrum and is infiltrating the skin or the subcutaneous tissues directly beneath it. At times this defect is large and opens directly into the mouth and nose as well as into the antrum. In fact, it is often much larger than was anticipated in view of the very limited involvement of the skin and subcutaneous tissues, because of the tendency of the thinned-out skin to roll inward as healing occurs. When the tumor is already perforating the cheek, it is usually of decided advantage to carry out the electrocoagulation through this area, as an opening in the roof of the mouth may thereby be avoided, while an external perforation is bound to occur in any event. Not infrequently, when the neoplasm has eroded through the upper part of the antral wall or the floor of the orbit sequestration of the lower orbital border or of a portion of the malar prominence may result. Complete loss of the eye is not a rare occurrence in these cases. The ocular globe is at times destroyed by the heat of the electrocoagulation or by the reaction from the radium used inside the antrum, when perforation of the bone was not present previously. The patient should always be warned of this possibility. In some instances, even though there is loss of the entire lower portion of the bony orbit, the eyeball miraculously remains unharmed and the vision in the eye unimpaired. However, considerable deformity and interference with function develop in these cases, since the eye recedes and sags markedly; it is supported only by a hammock of soft tissue, and diplopia, often of pronounced degree, results.

Displacement of the orifice of Stenson's duct occurs frequently as healing takes place within the antrum. This is due to traction of the scarring on the mobile mucous membrane lining of the cheek. In the usual case this altered position of the orifice is of no consequence, and

the patient is not even aware of it. Rarely, however, the opening of the parotid duct may be drawn so high upward and anteriorly into the antrum that saliva drains into the nasal fossa and thence from the nostril.

The optimum time for repair of the deformity is an important consideration. Opinions vary greatly in this regard. In the clinic of Professor Pichler in Vienna, which I visited recently, resection of the superior maxilla is carried out for the removal of the tumor, and if sacrifice of the full thickness of the cheek is necessary an immediate plastic closure is done even though this requires bringing up a flap from the neck and thorax. To the majority of surgeons, as to the professor's own assistant, this procedure seems daring. On the other hand, some surgeons prefer to delay proceeding with correction of the deformity for from two to four months. At the Mayo Clinic it has been regarded as an unjustified procedure to undertake repair before the patient has been free from evidence of the malignant disease for approximately a year, and it is common to wait much longer. This tides the patient over the period during which there is greatest likelihood of recurrence. I have, however, observed a return of the growth after approximately two years in several instances. This delay also permits the sequestrum to separate, the margins of the defect in the cheek and palate to heal over and the inflammatory reaction to subside. While a plastic closure can often be made much more readily immediately after excision of the tumor, as one does not then have the scarring and fixation of the tissues to contend with, there is a considerable risk of covering a small portion of the neoplasm that has not been completely removed. Should a recurrence develop beneath the grafted tissues, its recognition will be much longer delayed than it would have been if the defect had been left open. Sacrifice of a varying amount of the graft, together with a considerable portion of the adjacent normal tissue, would then be necessary. Moreover, when immediate repair is planned, there is often a tendency for the operator to save questionable tissue, sacrifice of which would increase the difficulty of closing the wound.

Procedures for the repair of the defects in the palate and cheek vary greatly, depending on the situation and size of the perforation, the training of the surgeon and whether or not the services of a competent dentist are available. A perforation in the palate or alveolar process may be dealt with surgically, but as a rule it is better closed with a special denture. This is made to furnish any teeth which it has been necessary to sacrifice, and it is held in place by means of clasps about the remaining upper teeth. In case the upper jaw is edentulous, spring clasps that overlap the margins of the defect or spring supports that are attached to the lower teeth or denture are required. There is

rarely sufficient mucoperiosteum remaining on the palate to permit of surgical repair, and a skin flap is not satisfactory for this purpose in most cases. While a cutaneous flap effectually occludes the opening, it remains soft and flabby and is not sufficiently rigid to withstand the suction necessary to hold an artificial denture in place. The dental plate worn over such a skin flap accordingly requires special mechanical support, and in most instances it might better have been used for closure primarily.

When a perforation through the cheek also is present, the denture used to close the palatal opening may be made to support a prosthesis for closure of the former as well. Such a prosthetic appliance is not infrequently employed for this purpose, although most patients much prefer to have a defect in this prominent situation repaired with their own tissues. At the Mayo Clinic a mechanical means has occasionally been used for closure temporarily, until it seemed safe to proceed with plastic repair. The prosthesis can be made sufficiently inconspicuous to enable the patient to resume his work during this period (figs. 1 to 4).

In most instances repair of a perforation through the cheek will require bringing in tissue from a distance by means of a pedicle flap, although if the opening is small a satisfactory closure can often be made by paring the margins and directly approximating them after wide undercutting. This is the simplest type of closure; it requires a single operation and a minimum amount of time, usually not over a week. On the other hand, when a pedicle flap is necessary multiple operations, with several periods of hospitalization over a longer time, are involved.

A flap for this purpose may be secured from the forehead, neck, arm, thorax, back or abdomen. The most useful sites are the forehead and the thorax. For women the temporofrontal or the frontal region is frequently the site of selection, as the hairdress can be made to conceal the skin graft and scar on the forehead effectually. For men, the thorax is usually preferable, as the scarring in the frontal region is unduly prominent unless the patient has a very thin skin. Flaps from the forehead possess the decided advantages of proximity and vascularity, which make it possible to transfer them more rapidly; the color and texture of the skin of the forehead also render the repair less conspicuous. If a flap is taken from this region it is possible to complete the repair in from four to six weeks. A flap taken from the thorax for repair of a defect in the cheek must be tubed, which requires an additional surgical procedure. Moreover, the great length of the flap required for this purpose and the comparative avascularity of the tissues over the upper portion of the thorax necessitate a delay of at least three months after the tubing to permit a satisfactory blood supply to develop in the upper pedicle. The outstanding advantages of such a flap are

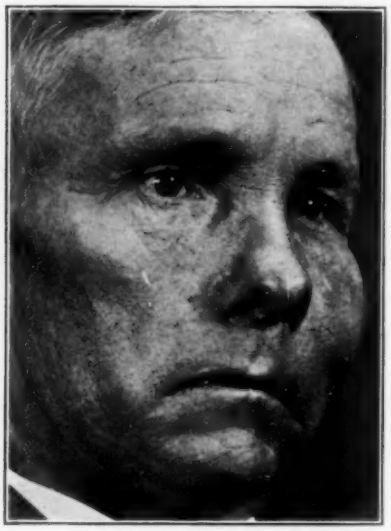

Fig. 1.—Extensive recurring squamous cell epithelioma (grade 3) of the left antrum, upper jaw and cheek of a man aged 51. The tumor is bulging and about to perforate the cheek.

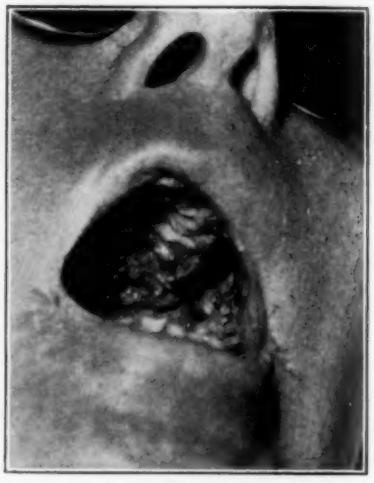

Fig 2.—Fungating tumor presenting in the roof of the mouth of the patient shown in figure 1.

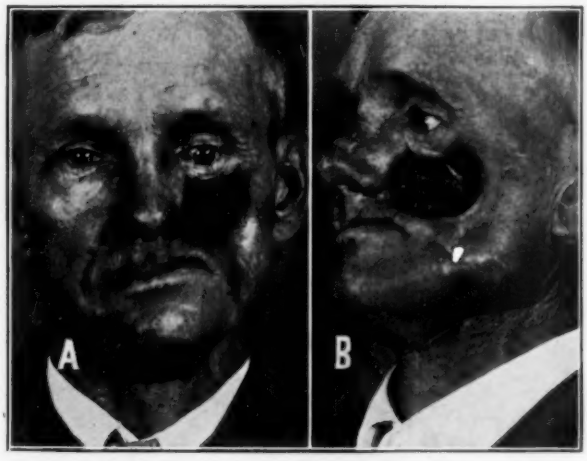

Fig. 3.—Left, patient shown in figures 1 and 2, nine months after the removal of the tumor by electrocoagulation and radium. In addition to the large perforation in the cheek there was destruction of the bony floor of the orbit and of the nasoantral wall; a large perforation was present in the roof of the mouth. Right, same patient. Metastasis into the cervical lymph nodes was present. The lymph nodes have been removed.

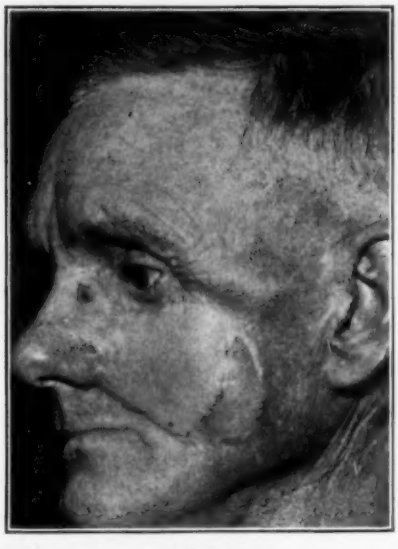

Fig. 4.—Patient shown in the preceding figures, four years after the removal of the malignant tumor of the left antrum. The perforation in the cheek and that in the roof of the mouth have been repaired with a tubed flap from the thorax.

that an almost unlimited amount of tissue for repair is secured and that the resultant scarring is on a covered portion of the body. The chief disadvantages are the greater length of time required and the fact that the repair is more conspicuous, as the color and texture of the skin do not match that of the rest of the face (fig. 5).

It is essential that the portion of the flap to be utilized in repairing the perforation be lined. This may be accomplished by turning under

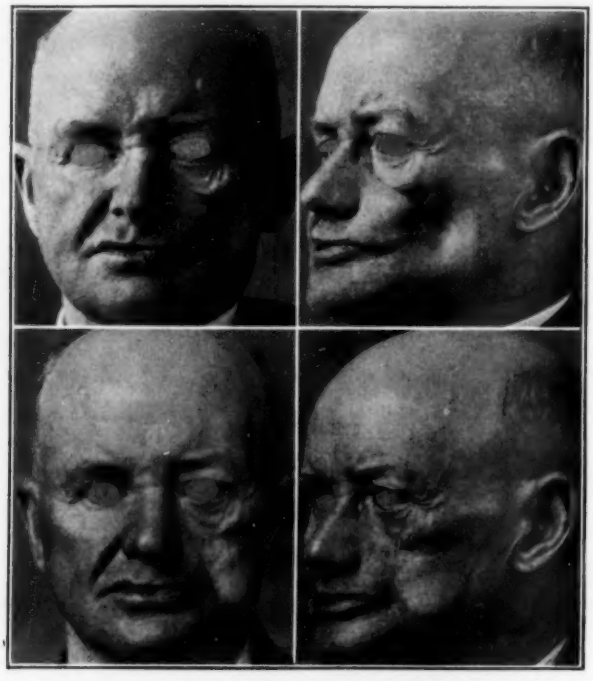

Fig. 5.—Above, postoperative perforation of the cheek following removal with electrocoagulation and radium of extensive recurring epithelioma (grade 3) of the left upper jaw, antrum and cheek. Below, same patient after closure of the perforation with a tubed flap from the thorax.

the distal end of the flap on itself, but a full thickness skin graft is usually preferable, as its application requires no more time than the former and the part of the flap utilized in the actual repair remains thinner, less bulky and more pliable. The cosmetic result also is more satisfactory. At times a lining is secured by turning in a flap of skin from the margin of the defect and covering it with the flap transplanted from the forehead or thorax. This procedure possesses the disadvantage of making it necessary to graft a larger area on the face. When a

free skin graft is used for a lining it must be applied to the flap approximately two weeks prior to transference in order to permit it to become attached firmly.

Retraction and elevation of the upper lip and angle of the mouth due to scarring and loss of the bony support of these structures result in a conspicuous deformity. For correction it is necessary to free widely the scarred attachment of the lip and cheek to the superior maxilla and to roll out the mucous membrane which has been drawn upward inside the lip. A Thiersch or shaved skin graft from the arm or thigh, which has been wrapped about dental compound with its deep surface outward, is then applied to the denuded inner surface of these structures in order to restore their lining. The graft is best taken from a surface that is free of hair, for, while it should be cut so thin that hair follicles are not included, there is always a possibility of transplanting some of them into the mouth. The stent bearing the graft is best held in place by means of an appliance attached to the teeth. In the absence of teeth in the upper jaw, the dental compound mold may be fused to the patient's upper denture, or silk sutures may be passed about the stent, through the cheek, and tied over a gauze pad on the outer surface. The jaws are immobilized when feasible by means of interdental wiring, so that the stent and graft will remain firmly in position. The stent is kept in place for ten days. On its removal the graft will almost invariably be found lining the restored buccal fold and firmly adherent. Providing immobilization can be maintained, a thin graft of this type seems to take practically as well within the contaminated oral cavity as on the surface of the body. Unless kept under tension for several months, however, it undergoes marked shrinkage. It is accordingly necessary to replace the dental stent immediately with vulcanite. This must be worn continuously until the permanent prosthesis is ready. If it is left out for only a day at this time, the new buccal fold will be drawn down to such a marked extent that little will be accomplished by the operation. Once the lip and cheek have been mobilized by relining them in this manner, the symmetry of this portion of the face is readily restored with a proper prosthesis (fig. 6).

Loss of the inferior orbital border requires either a bone or a cartilage graft. While human cartilage that has been preserved in an aqueous solution of metaphen or that has been freshly removed from the patient's rib may be used for this purpose, it is, as a rule, less satisfactory than bone because of its lack of rigidity. For restoration of the orbital floor and for elevation of the ocular globe, however, it is usually of decided advantage, as it can be shaped more readily than can bone. A bone graft from the iliac crest serves well for restoring the inferior orbital border. It is easily shaped with bone forceps and

is then inserted in a bed prepared by tunneling with scissors in the soft tissues of the upper part of the cheek, through a small lateral incision. With proper beveling of its ends, it will at times remain in position without anchoring. When necessary to anchor it, I have found, driving a short piece of a straight needle through it into the underlying bone serves the purpose well. The needle is inserted directly through the overlying skin and must be so short that its deep end will not protrude into the nose or antral cavity. Its outer end is driven down flush with the surface of the graft. I have never seen this device cause trouble later, and it does immobilize the graft securely.

Displacement of the orifice of the parotid duct as a result of postoperative scarring is rarely so pronounced and in such a situation as

Fig. 6.—Left, deformity following removal with diathermy and radium of an extensive, recurring grade 4 squamous cell epithelioma of the left antrum, cheek and orbit of a woman aged 53. The tumor had been explored previously through the cheek and was perforating the cheek; sequestration of the bony floor of the orbit and malar bone has occurred; the eye was destroyed by the reaction from the operation and irradiation. Right, same patient, two years after the removal of the epithelioma. The perforation in the cheek has been closed with a flap from the forehead; a graft from the crest of the ilium has been inserted to restore the lower orbital border and malar prominence; the patient is wearing an artificial eye.

to require consideration. In one of the cases which I observed, the opening of the duct was drawn upward into the antrum, and the resultant drainage of saliva from the nostril caused the patient much more annoyance than did the deformity of the distorted upper lip or the speech defect which resulted from perforation of the palate. It necessitated her largely foregoing the pleasure of social affairs, since anes-

thesia over the distribution of the infraorbital nerve rendered it impossible for her to tell when salivary secretion was present in the nostril until it dripped from the nose or ran down onto her lower lip. Inhalation of cold air tended to stimulate the secretion, probably because the absence of the nasoantral wall and the large perforation through the floor of the antrum permitted the current of air to pass directly through the nostril into the mouth. Thus, the secretion was often bothersome while she was on the street. It was especially prone to drip from the tip of the nose as she sat with her head tipped slightly forward at the bridge table or dinner table. Eating caused particularly active secretion. While it was apparent that the meatus of Stenson's duct had been drawn up into the antrum during the process of healing, careful search failed to reveal the site of this opening. In an attempt to correct the condition, the cheek and upper lip, which were bound directly to the margin of the antral perforation by scar tissue, were freed and the denuded surface covered with a skin graft. Although this restored the buccal fold and corrected the facial deformity satisfactorily, the drainage of saliva from the nostril continued as actively as ever.

Further attempts to locate the displaced outlet of Stenson's duct were unavailing until secretion of the parotid gland was actively stimulated by having the patient suck a lemon. The orifice was then found on the anterior wall of the antrum, just above the perforation in the palate. The obvious route of salivary drainage from this point, because of complete loss of the nasoantral wall, was directly into the vestibule of the nose and out through the nasal meatus.

The problem then was either to dry up or to divert the secretion of the parotid gland. It did not seem likely that drying up of secretion could be completely accomplished by means of irradiation or evulsion of the auriculotemporal nerve, and transplantation of Stenson's duct was decided on, although no precedent for this procedure could be found in the literature (figs. 7 and 8).

Pentothal sodium (sodium ethyl-methyl butyl thiobarbiturate) was administered, and the parotid duct was readily picked up through a small incision on the inner surface of the cheek, below and posterior to its opening in the antrum. The duct was followed upward and cut across just at its antral opening, and the free end was transplanted into a stab wound in the approximate situation of the meatus of the normal duct. Primary healing occurred, and the new meatus functioned normally. The patient has been fitted with a special denture which satisfactorily closes the perforation in the palate. Her symptoms have been relieved completely.

Fig. 7.—Patient three and a half years after electrocoagulation of an adenocarcinoma that was filling the left antrum. Elevation of the upper lip has been corrected by relining the lip and labial sulcus with a skin graft. A prosthesis is being worn to support the lip and close the perforation which extends through the roof of the mouth into the antrum.

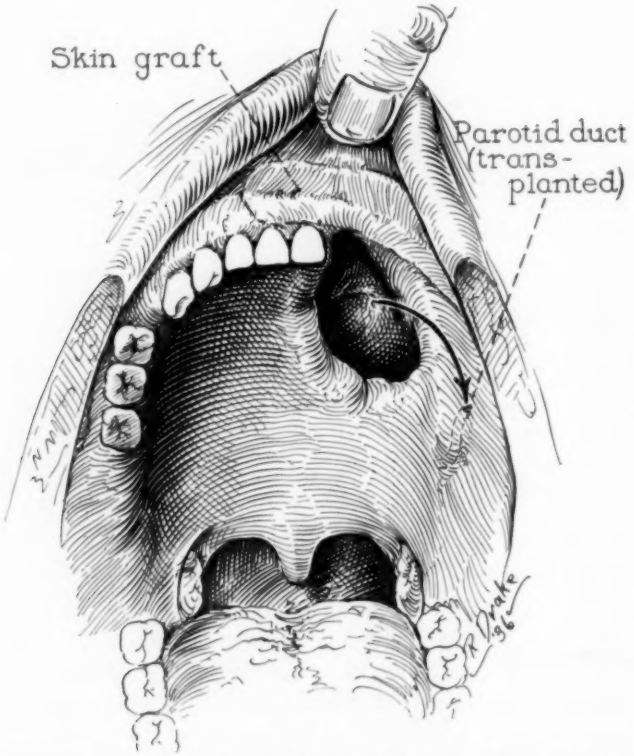

Fig. 8.—Drawing showing the perforation through the roof of the mouth into the antrum, the transplanted Stenson's duct and the skin graft relining the labial sulcus (same patient as shown in figure 10). The meatus of Stenson's duct had been drawn up into the antrum by the scarring, and saliva was draining into the nose. The meatus of the duct was transplanted into approximately its normal position in the mouth.

SUMMARY

Facial deformity usually does not occur after removal of a malignant tumor of the antrum unless the growth is extrinsic. The most common disfigurements encountered are elevation and retraction of the upper lip and angle of the mouth, perforation of the cheek and nose and loss of the malar prominence, the inferior orbital border and the eye. Displacement of the meatus of the parotid duct rarely is sufficiently marked to produce symptoms. Satisfactory plastic correction of the deformities is possible in most cases.

IMPROVEMENT OF HEARING IN CASES OF OTOSCLEROSIS

A NEW, ONE STAGE SURGICAL TECHNIC

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NEW YORK

The early efforts of Jenkins [1] and Bárány [1a] and the recent efforts of Holmgren [2] and Sourdille [3] to ameliorate deafness in cases of otosclerosis by surgical means have led to the conclusion that when improvement in hearing has been obtained by the making of a new fenestra in the bony capsule of the labyrinth the early closure of this labyrinthine fistula by bony regeneration must be prevented surgically in order to maintain this improvement in hearing permanently.

Sourdille,[4] who performs what he terms a tympanolabyrinthopexy in three principal stages at intervals of four or five months, stated:

> In a great number of cases, unfortunately, the success is ephemeral: four, six, or ten weeks later, one sees the aerial hearing diminish, the Rinne becomes negative and the Weber indifferent. At the same time, the air pressure in the meatus can attain 40 and even 60 cm. of water without determining nystagmus, nor a sensation of vertigo. This is due to the fact that the labyrinthine fistula closes, due to the reconstitution of a rigid bony layer, which rarely attains the thickness of the primitive bony wall of the canal, and more often does not exceed a few tenths of a millimeter. It suffices, in a complementary operation, to extract this bony film, to see the hearing gain of the first operation return, and sometimes be even greatly increased. This time the result will be lasting, the regenerating process of the bone becoming gradually exhausted. In many cases, however, I had to open the labyrinth three times.

Sourdille [5] further stated:

> We must still work to solve this problem of osteo-genesis, which will diminish not only the unpleasantness of reopening the labyrinth, but one of the causes of grave failure: the injury of the membranous canal.

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1. Jenkins, G. J.: Treatment of Otosclerosis, J. Laryng. & Otol. **29**:520, 1914.

1a. Bárány, R.: Die Indikationen zur Labyrinthoperation, Acta oto-laryng. **6**:260, 1924.

2. Holmgren, G.: The Surgery of Otosclerosis, Ann. Otol., Rhin. & Laryng. **46**:3 (March) 1937.

3. Sourdille, M.: New Technique in the Surgical Treatment of Severe and Progressive Deafness from Otosclerosis, Bull. New York Acad. Med. **13**:673 (Dec.) 1937.

4. Sourdille,[3] p. 688.

5. Sourdille,[3] p. 690.

Holmgren [6] asked:

> How shall the fistulae be made in order to produce the greatest primary improvement in hearing and how shall they later be handled in order to achieve the greatest permanent good? Those are the two important questions demanding attention. Once these are answered, one may expect that the surgical management of otosclerosis will be successful in the hands of those who can maintain the necessary asepsis.

Holmgren [7] said:

> It is possible to obtain permanently open fistulas of the labyrinth, but up till now this has been the case only occasionally with the material of Sourdille's and mine, and there is not any method known of which is leading to the goal.

The technic which I shall describe provides a surgical means of obtaining a permanently open fistula of the labyrinth by mechanically preventing regeneration of bone by a one stage endaural plastic reconstruction of the auditory mechanism which incorporates the following surgical principles:

1. The decompression and mobilization of the labyrinthine perilymph by the surgical construction of a trough-shaped fenestra in the bony capsule of the external semicircular canal.

2. The preservation of this surgically created mobility of the labyrinthine perilymph by replacement of the removed area of bony labyrinthine capsule with a suitable and durable membrane which is inserted into the fenestra and maintained permanently in direct contact with the perilymph.

3. The arrest of the progressive labyrinthine venous stasis by decompression of the dura of the temporal lobe in the region of the epitympanic recess.

TECHNIC

Preparation of Operative Field.—The mastoid region is shaved. The auricle and the area of skin surrounding it are scrubbed with soap and water, dried and painted with solution of tincture of metaphen. About 5 drops of the solution is then instilled into the auditory canal, and the entire membranous lining of the auditory canal and the tympanic membrane are allowed to bathe in it for a few minutes, after which the canal is dried with a sterile applicator.

Anesthesia.—A combination of analgesia and local anesthesia is employed. General anesthesia is contraindicated because in order to carry out this technic successfully bleeding must be kept at a minimum and because the cooperation of the patient is necessary during the stage of fenestration of the external semicircular canal.

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6. Holmgren,[2] p. 12.

7. Holmgren, G.: Letter, dated April 12, 1938, read by Dr. T. J. Harris at the meeting of the American Otological Society, May 6, 1938.

Analgesia (as outlined by Dr. J. Branower): Two hours before the time scheduled for operation the patient is given 1½ grains (0.09 Gm.) of neonal (n-butylethylbarbituric acid) and 1½ grains (0.09 Gm.) of sodium pentobarbital (sodium ethyl-(1-methyl-butyl)-barbiturate) by mouth. One hour later a hypodermic injection of ¼ grain (0.016 Gm.)

Fig. 1.—The creation of a mobile endaural membranous and extracartilaginous window for the antauricular surgical approach to the temporal bone, showing the antauricular suprameatal membranous triangle.

of morphine sulfate and $\frac{1}{200}$ grain (0.0003 Gm.) of scopolamine is given. A hypodermic injection of ¼ grain (0.016 Gm.) of morphine sulfate is given immediately before the patient is taken to the operating room.

Local Anesthesia: A 1 per cent solution of procaine hydrochloride and 1:20,000 epinephrine hydrochloride is injected into the skin, fibrous

tissue and periosteum of the antauricular suprameatal membranous triangle. The same solution is injected into the skin, the fibrous tissue and the periosteum of the membranous portion of the posterior wall of the canal, which includes the outer third of this wall and extends from the anterior border of the concha inward as far as the osseous portion of the posterior wall.

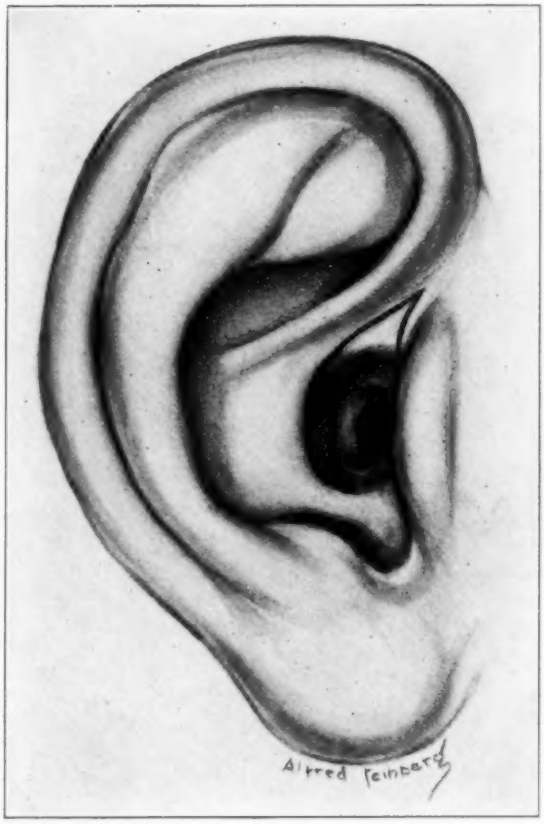

Fig. 2.—The creation of a mobile endaural membranous and extracartilaginous window for the antauricular surgical approach to the temporal bone, showing three endaural incisions.

The technic may be divided into the following surgical steps:

1. *The Creation of a Mobile Endaural Extracartilaginous Membranous Window for the Antauricular Surgical Approach to the Temporal Bone.*—Three endaural incisions are made. The first is begun in the membranous lining of the superoposterior wall of the external auditory canal, at the junction of its osseous and membranous portions. This incision is carried downward and outward along the entire mem-

branous portion of the posterior wall of the canal until the lower end of the anterior border of the concha is reached. The second is begun at the point of commencement of the first incision in the superoposterior wall of the canal, is carried along and through the membranous lining of the outer third of the superoposterior wall and is continued upward adjacent to the tragus, into and along the anterior wall of the antauricular suprameatal membranous triangle and through the skin, the fibrous

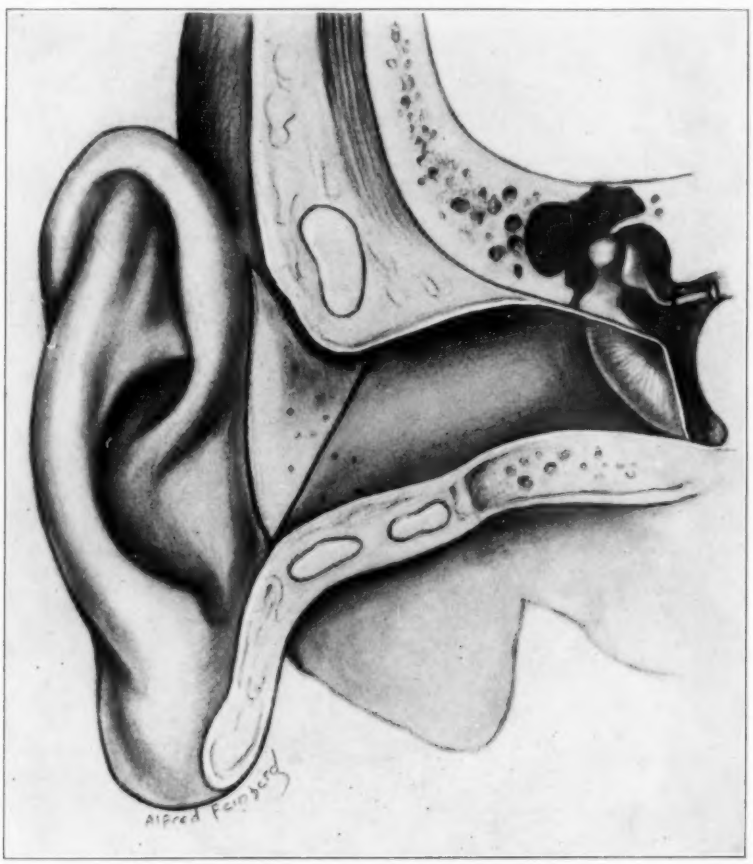

Fig. 3.—The creation of a mobile endaural membranous and extracartilaginous window for the antauricular surgical approach to the temporal bone, showing section view of the three endaural incisions (fig. 2).

tissue and the periosteum up to the apex of this triangle. The third, which connects the first two incisions along the anterior border of the concha, is begun from the outer end of the first incision at the lower end of the anterior border of the concha, is carried upward through the skin, the fibrous tissue and the periosteum along the entire anterior border of the concha and continued along and adjacent to the anterior

border of the helix, which forms the posterior boundary of the antauricular suprameatal membranous triangle, up to the apex of the triangle where it meets the outer end of the second incision. These incisions are so designed that they remain extracartilaginous and extramuscular.

The incisions should be carefully outlined at first by carrying them through the skin only; when the correct outline is successfully obtained,

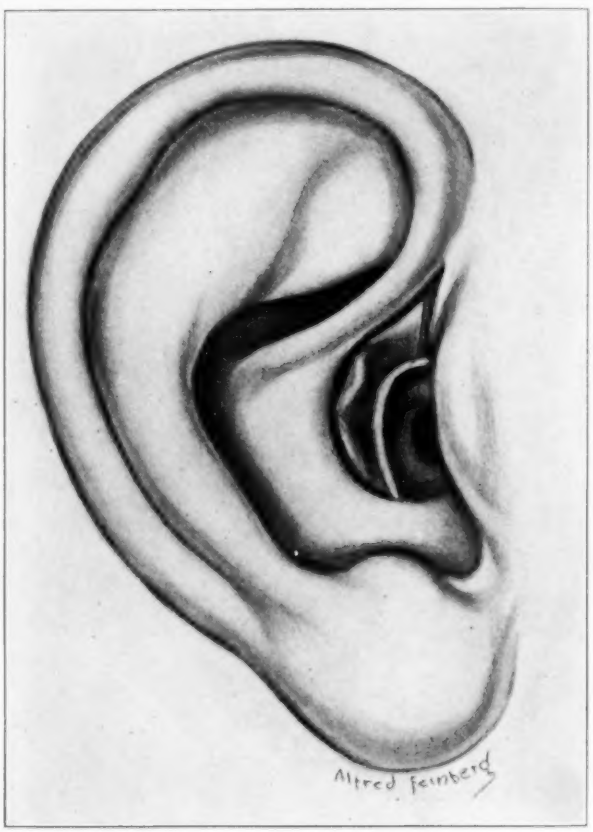

Fig. 4.—The creation of a mobile endaural membranous and extracartilaginous window for the antauricular surgical approach to the temporal bone. The endaural membranous flap has been removed, and the endaural membranous window can be seen.

they may then be carried deeper, through the rest of the membranous layers down to the bony surface of the temporal bone. The importance of making these incisions with the greatest accuracy and precision is twofold: 1. On these incisions depends the surgical accessibility of the temporal bone. 2. The incisions designate the extent of the cutaneous lining of the posterior and superior walls of the canal which is to be

left behind and later employed in the creation of the tympanomeatal membrane. A triangular flap of membranous tissue results from these three incisions.

A periosteal elevator is now inserted into the first incision, and while the underlying bony surface is hugged with the edge of the instrument, the entire triangular flap is subperiosteally lifted from its attachment to the bony surface. The upper and the lower end of this flap are then

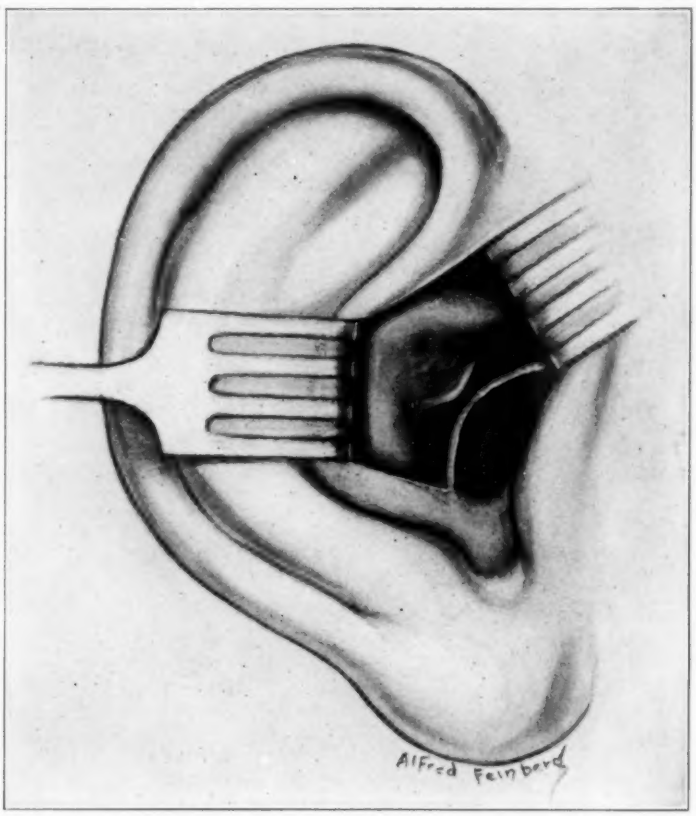

Fig. 5.—The creation of a mobile endaural membranous and extracartilaginous window for the antauricular surgical approach to the temporal bone, showing completion of the antauricular exposure of the mastoid process.

freed from their final attachments with the aid of curved scissors. This triangular flap, which consists of the outer third of the membranous lining of the posterior and the superoposterior wall of the canal and contains hair follicles and ceruminous glands, is removed and discarded. The removal of this membranous flap results in an endaural extracartilaginous membranous window for the antauricular surgical approach to the temporal bone. This endaural membranous window is now

mobilized by a subperiosteal elevation of both the postauricular skin and periosteum covering the outer mastoid cortex and the antauricular skin and periosteum covering the posterior root of the zygoma. Two retractors are inserted and held in position by an assistant.

With the retractors in situ, the endaural membranous window can be moved in any desired direction over the temporal bone to permit the necessary surgical intervention. The first endaural exposure of the temporal bone obtained with this described technic reveals the outer mastoid cortex with Macewen's area, the spine of Henle, the outer border of the anterior mastoid cortex and the posterior root of the zygoma.

2. *The Exposure and Sharp Definition of the Horizontal External Semicircular Canal.*—The cutaneous lining covering the osseous portion of the posterior wall of the external auditory canal is subperiosteally elevated with a specially devised narrow subperiosteal elevator for a distance of about 5 mm., in order to expose the superoposterior bony wall of the canal. With an electrically driven serrated dental burr the antrum is entered through the superoposterior wall, the burr being directed posteriorly and inward. With the same burr an area of mastoid cortex is removed from the superoposterior wall and from the outer mastoid cortex over Macewen's triangle, and a larger point of entrance and greater accessibility to the mastoid antrum are thus created.

With an electrically driven no. 3 round burr more of the outer cortex is removed. The cellular structure immediately underlying this cortex and surrounding the mastoid antrum is removed with a no. 1 curet. The roof of the mastoid antrum is quickly located, and the cellular structure adjacent to it is removed until the smooth inner bony table covering the middle fossa dura in the region of the mastoid antrum is exposed to view. The outer cortex of the posterior root of the zygoma is removed with a no. 3 round burr. The zygomatic cells overhanging the entrance from the antrum to the aditus are removed with a no. 0 curet. With the same curet the floor of the antrum is scraped, and all the basal perilabyrinthine cells encountered are removed until the solid ebonized base of the basal labyrinthine portion of the petrous pyramid is exposed to view. The antral posterior end of the floor of the aditus is curetted, and the external semicircular canal, which forms the threshold between the antrum and the aditus, is exposed to view. The contour of the horizontal external semicircular canal is sharply defined by removal of all the cellular structure immediately surrounding it. The sharp definition of the external semicircular canal is complete when its convexity appears elevated and projects prominently from the floor of the aditus and antrum, with its anterior and posterior borders freed from surrounding cellular structure.

3. *Plastic Construction of the Cutaneous Tympanomeatal Membrane.*—The tympanomeatal cutaneous membrane is a one piece membrane consisting of a meatal and a tympanic portion. The meatal portion consists of the thin cutaneous lining freed from its attachment to the posteroinferior, the posterior, the superoposterior, the superior and the anterosuperior bony wall of the external auditory canal. The tympanic portion consists of the tympanic membrane, the posterior, the supero-

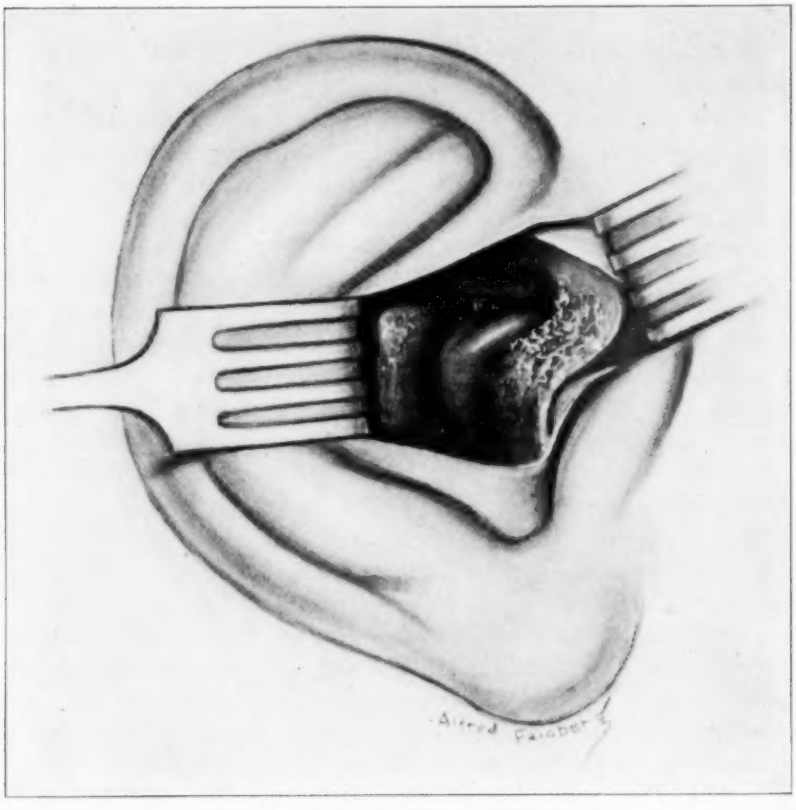

Fig. 6.—Exposure and sharp definition of the external semicircular canal.

posterior, the superior and the anterosuperior margin of whose circumference were freed from the sulcus tympanicus and whose fibrocartilaginous ring was left attached only to the remaining anterior and inferior walls of the sulcus tympanicus. The tympanic and meatal portions of the tympanomeatal cutaneous membrane are joined and held together by the delicate cuticular outermost layer of the tympanic membrane, which extends from and is a part of the cutaneous lining of the bony canal wall which forms the meatal portion of the membrane.

The cutaneous lining, which forms the meatal portion of the tympanomeatal membrane and unites this portion with the tympanic portion by extending to form the delicate outer cutaneous layer of the tympanic membrane, is very thin. In its extent outward from the margin of the membrana tympani for a distance of about 10 mm. the thickness of the meatal portion varies from 0.01 to 0.03 mm. The tympanomeatal membrane, when completed, is the thinnest cutaneous membrane that could possibly be obtained plastically or grown biologically. It is

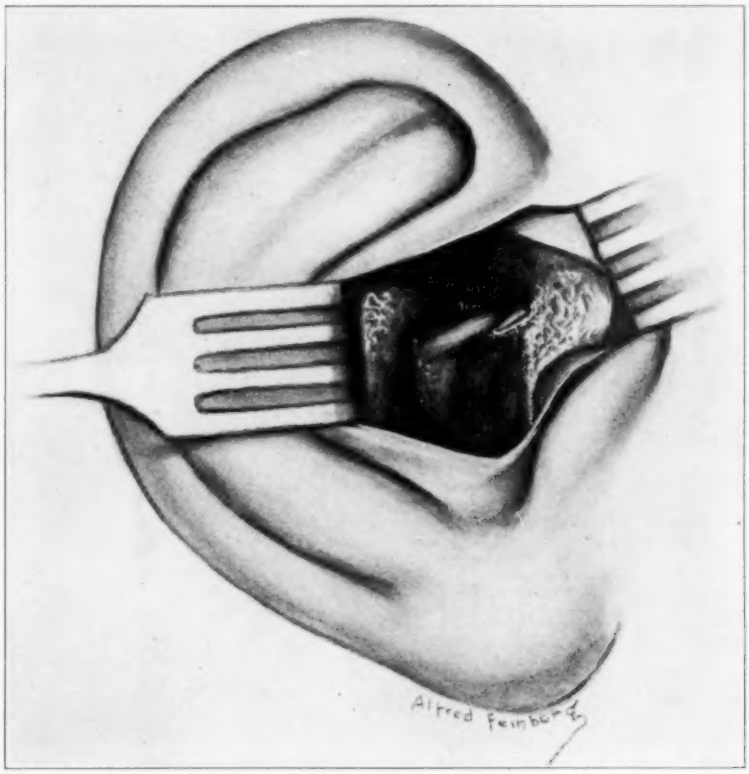

Fig. 7.—The plastic construction of the tympanomeatal cutaneous membrane, showing skeletonization of the posterior and the superoposterior bony wall of the external auditory canal, which results in the exposure of the body of the incus.

destined to seal the perilymph space through the window which is to be created in the bony capsule of the external semicircular canal.

To obtain this cutaneous tympanomeatal membrane completely intact, without injury, without severing of the meatal portion from its attachment to the tympanic portion and without perforation of the tympanic membrane is a surgical task that requires great finesse. Experience has shown the safest method of freeing these membranes, united and

intact, from the bony structure to which they are attached to be first to skeletonize and then to resect the bony structures away from these membranes, instead of attempting to lift these membranes away from the bony structure.

The plastic construction of the cutaneous tympanomeatal membrane may be accomplished best and without undue surgical risk by the following surgical technic:

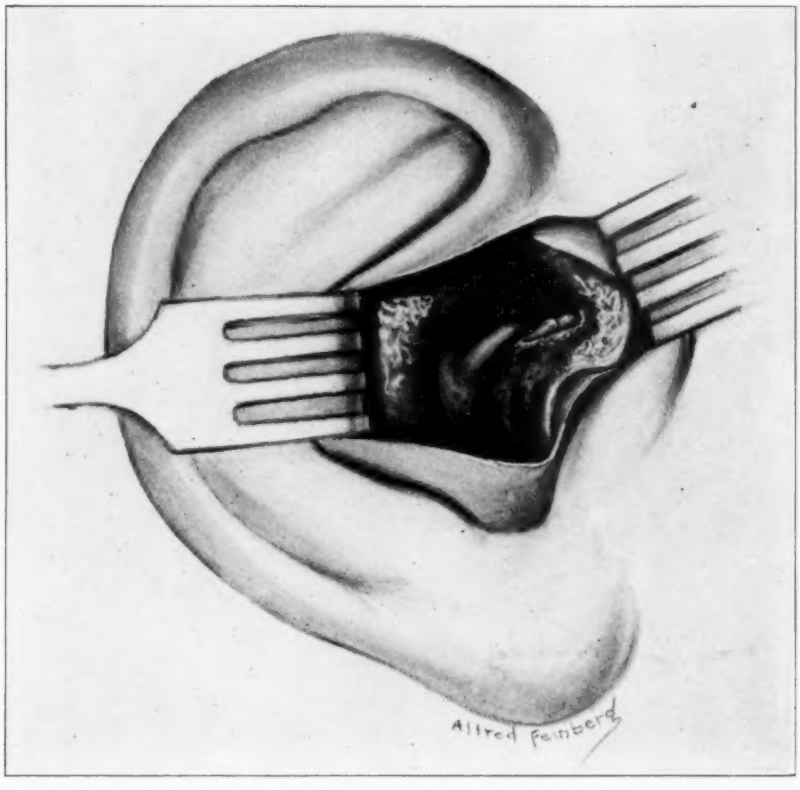

Fig. 8.—The plastic construction of the tympanomeatal cutaneous membrane, showing skeletonization of the superior bony wall of the external auditory canal, which results in an exposure of the incudomalleolar joint.

(*a*) Skeletonization of the Posterior and the Superoposterior Bony Wall of the Canal: With a no. 00 mastoid curet all the cells lying adjacent to and covering the posterior surface of the mastoid portion of the posterior bony wall of the canal are removed until a smooth bony surface free from cells is obtained. The cells lying adjacent to the posterior surface of the tympanic portion of the posterior wall are removed to the level of the bony capsule of the vertical portion of the facial nerve. The prominence of the external semicircular canal is

employed as a guide in tracing the anatomic position of the vertical portion of the fallopian canal. The outer cortex of the remains of the posterior root of the zygoma is removed further anteriorly, and the zygomatic cells lying adjacent to and covering the squamous portion of the superoposterior bony wall of the canal are removed until a smooth continuity of bony surface with that of the smoothened posterior surface of the mastoid portion of the posterior wall is obtained. As a result of this step in the surgical technic, the posterior aspect of the incus,

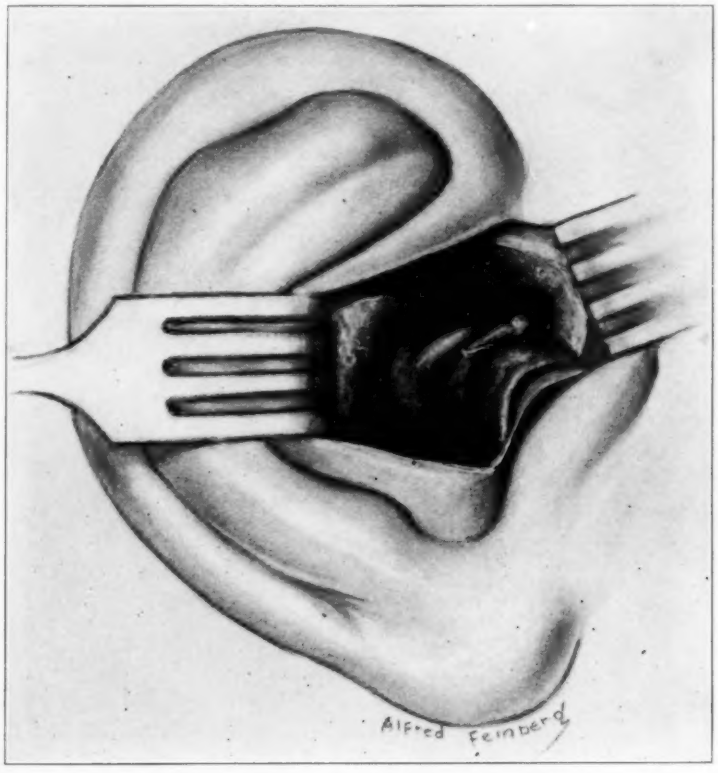

Fig. 9.—The plastic construction of the tympanomeatal cutaneous membrane, showing skeletonization of the anterosuperior bony wall of the external auditory canal, which results in an exposure of the entire epitympanic recess.

occupying a position almost parallel to and anterior and adjacent to the horizontal course of the prominence of the external semicircular canal, is brought into view.

(*b*) Skeletonization of the Superior Bony Wall of the External Auditory Canal: With a no. 2 round burr the outer cortex of the posterior root of the zygoma is removed farther anteriorly to expose the zygomatic cellular structure lying anterior and external to the incus

and adjacent to the upper surface of the squamous portion of the superior bony wall of the external auditory canal. With a no. 00 curet this cellular structure is completely removed, the operator working in a direction anterior to the already smooth and skeletonized superoposterior bony wall of the canal. Curetting gradually progresses from without inward, the entire upper surface of the superior bony wall of the canal up to the sulcus tympanicus being skeletonized until a smooth-

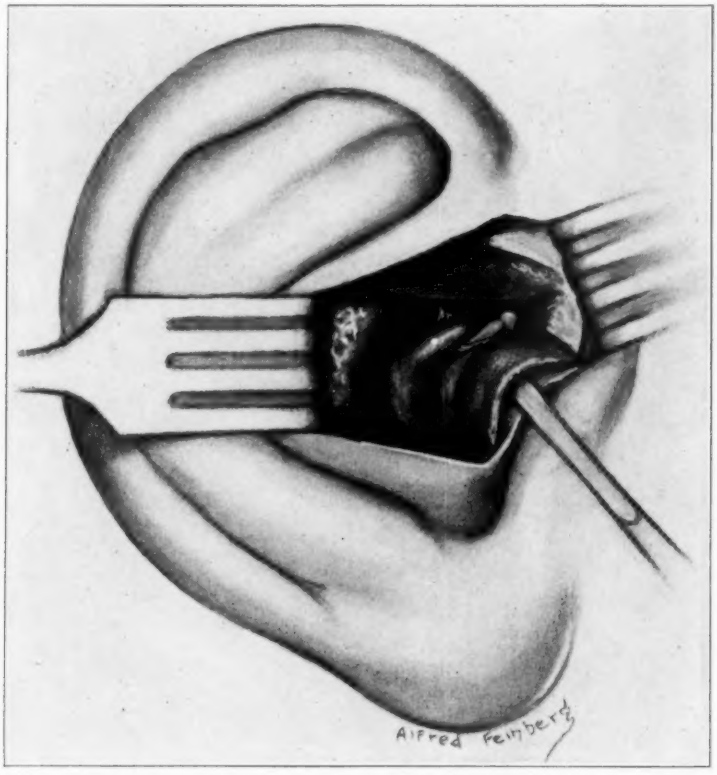

Fig. 10.—The plastic construction of the tympanomeatal cutaneous membrane, showing subperiosteal elevation of the cutaneous lining covering the posterior, the superoposterior, the superior and the anterosuperior bony wall of the canal (1 mm. at a time).

ened continuity with the superoposterior wall is obtained. As a result of this step in the surgical technic, the entire incudomalleolar joint in its position within the epitympanic recess is exposed to view.

(*c*) Skeletonization of the Anterosuperior Bony Wall of the External Auditory Canal: With the curet directed anterior to the head of the malleus and curetting being done from without inward, the upper surface of the curvature of the squamous portion of the anterosuperior

bony wall of the canal is smoothened and skeletonized up to the sulcus tympanicus. As a result of this surgical maneuver, the entire epitympanic recess is brought into view.

(*d*) Resection of the Skeletonized Posterior, Superoposterior, Superior and Anterosuperior Bony Walls of the Canal from Without Inward up to the Sulcus Tympanicus: A specially devised narrow periosteal elevator is inserted between the cutaneous lining and the skeletonized posterior and superoposterior bony walls of the canal, and the cutaneous

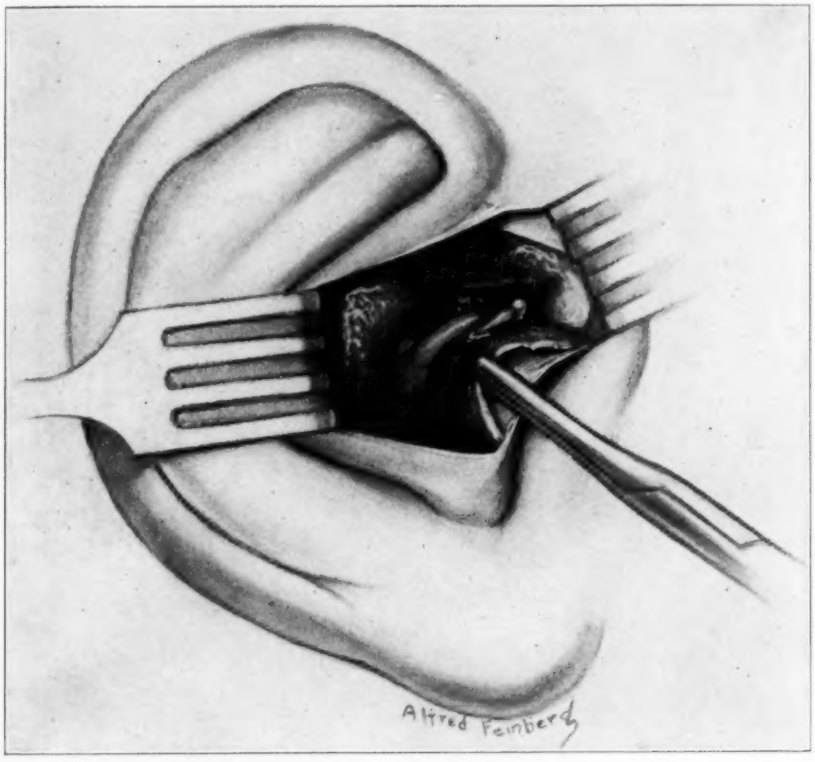

Fig. 11.—The plastic construction of the tympanomeatal cutaneous membrane, showing removal of the skeletonized posterior and superoposterior bony walls of the canal down to the level of the bony capsule surrounding the vertical portion of the facial nerve and the removal of the superior and the anterosuperior skeletonized bony wall down to the level of the sulcus tympanicus.

lining is gently separated from its attachment to the bony surface, 1 mm. at a time. Each millimeter of bony wall thus exposed is successively removed with a specially devised rongeur, up to the level of the bony capsule of the vertical portion of the facial nerve. The skeletonized superior and anterosuperior walls are removed up to the sulcus tym-

panicus by the same technic. This step in the technic must be accomplished without injury to the cutaneous lining of the bony canal.

(*e*) Skeletonization and Resection of the Sulcus Tympanicus: This is necessary in order to free the posterior, the superoposterior, the superior and the anterosuperior margin of the circumference of the tympanic portion of the tympanomeatal cutaneous membrane.

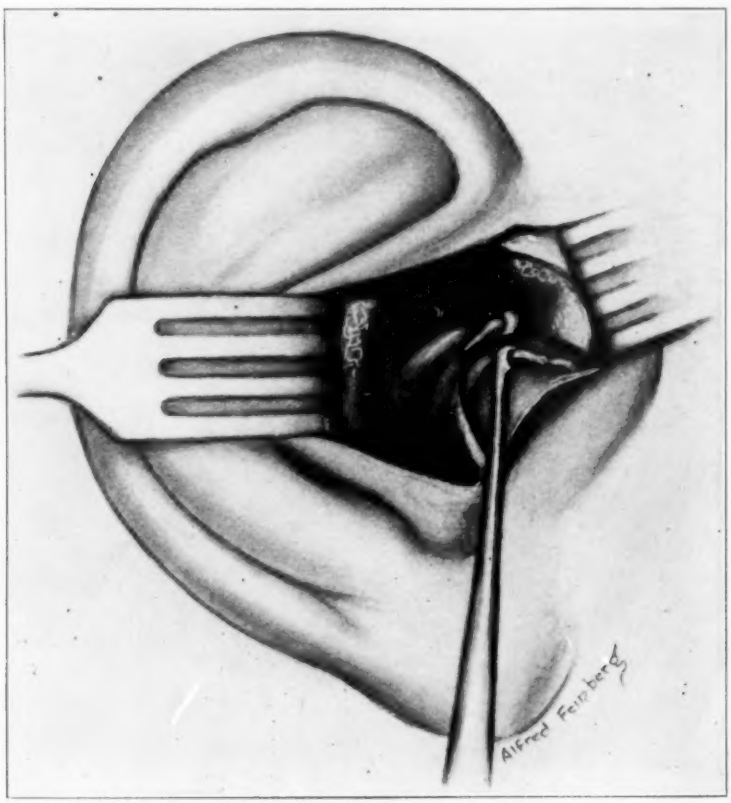

Fig. 12.—The plastic construction of the tympanomeatal cutaneous membrane, showing the skeletonization and removal of the sulcus tympanicus from the posterior, the superoposterior, the superior and the anterosuperior margin of the circumference of the tympanic membrane.

The portions of the sulcus tympanicus on either side of the notch of Rivinus, within which the posterior, the superoposterior, the superior and the anterosuperior margin of the circumference of the tympanic membrane are framed, are slowly and cautiously shaved away from the fibrocartilaginous ring of the tympanic membrane with a no. 000 mastoid curet. By slow shaving from below upward and then forward as far as the posterior edge of the notch of Rivinus, minute, extremely thin

portions of bone are removed from the posterior surface of the posterior and the superoposterior wall of the sulcus tympanicus. This shaving is continued until the sulcus tympanicus is skeletonized and becomes papyraceous, when it spontaneously fractures. It is then lifted in minute pieces away from the fibrocartilaginous ring of the tympanic membrane. As a result of this step in the technic, the posterior and the supero-

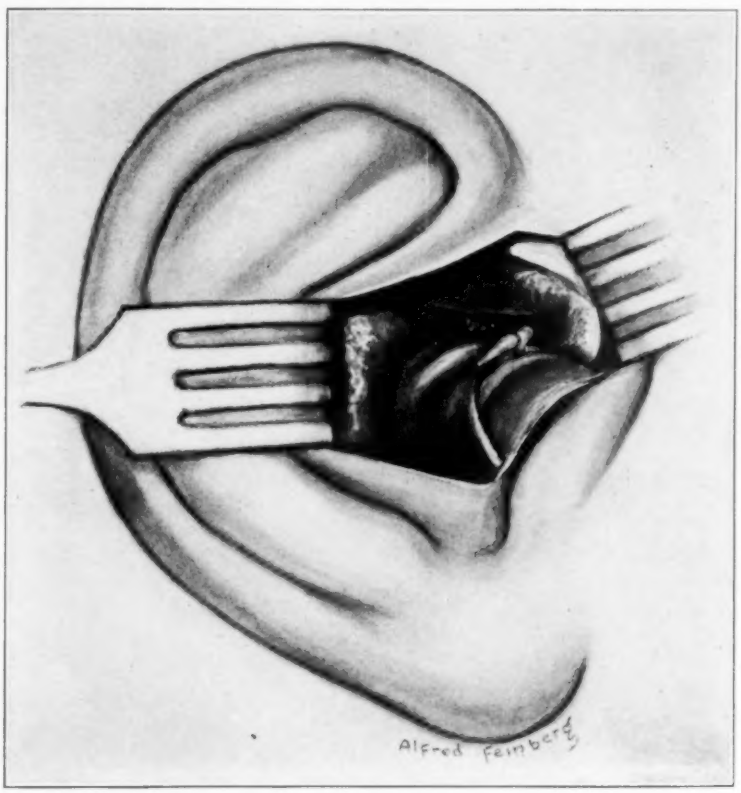

Fig. 13.—The plastic construction of the tympanomeatal cutaneous membrane after removal of the sulcus tympanicus, showing the long crus of the incus, the neck of the malleus and the tendon of the tensor tympani muscle attached to the neck of the malleus.

posterior margin of the fibrocartilaginous ring of the tympanic membrane are freed, and the long process of the incus is exposed to view.

The upper surface of the innermost margin of the superior bony wall of the canal which corresponds to the notch of Rivinus is gently skeletonized and removed from its cutaneous lining, which is continuous with Shrapnell's membrane, and the posterior and the anterior malleolar fold of the membrana tympani, which extend from the short process

of the malleus. This results in the freeing of Shrapnell's membrane and the exposure of the neck of the malleus.

The upper surface of the anterosuperior wall of the sulcus tympanicus, anterior to the anterior edge of the notch of Rivinus, is skeletonized by removal of minute shavings of bone until the sulcus tympanicus becomes papyraceous and fractures spontaneously. It is then lifted away piecemeal from the anterosuperior margin of the fibrocartilaginous ring of the tympanic membrane. After this part of the circumference

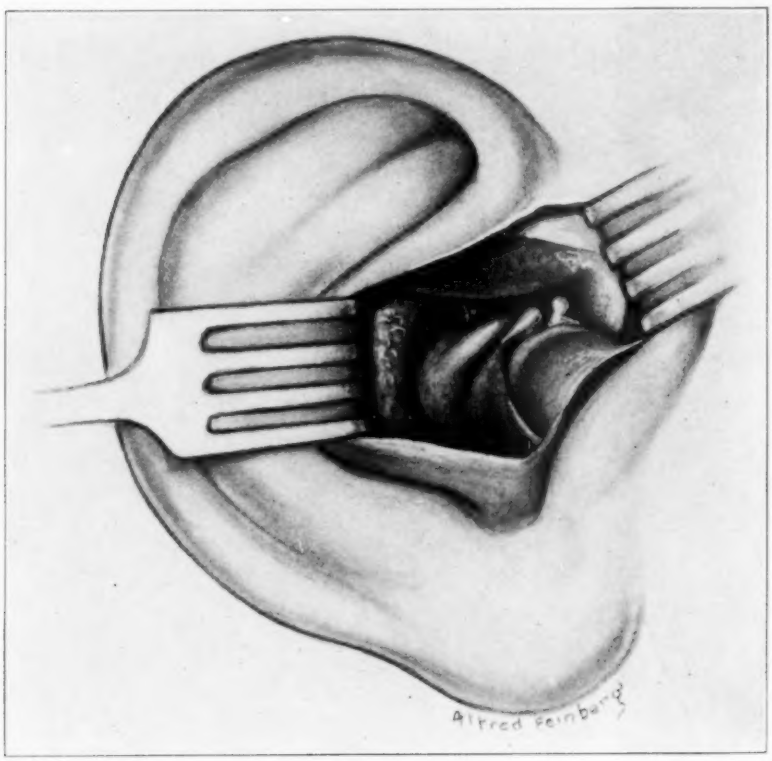

Fig. 14.—The liberation of the tympanic membrane from its anchorage to the ossicular chain, showing separation of the head of the malleus from the incus without disturbance to the position of the incus.

of the tympanic membrane has been freed, the tendon of the tensor tympani muscle, inserted into a slight projection near the upper end of the medial side of the manubrium mallei, is seen.

The resection of the amount of bony structure necessary for the creation of the cutaneous tympanomeatal membrane is now complete. There should be a continuous, completely intact, nonperforated tympanomeatal cutaneous membrane, whose tympanic portion is attached only to the remaining anterior and inferior walls of the sulcus tympanicus

and whose meatal part is left temporarily attached to the remaining inferior and anterior bony walls of the external auditory canal.

4. *Liberation of the Membrana Tympani from Its Anchorage to the Ossicular Chain.*—In order to permit the excursion of the tympanic portion of the tympanomeatal cutaneous membrane beyond and superoposterior to the tympanic cavity, the membrana tympani must be freed from its anchorage to the ossicular chain.

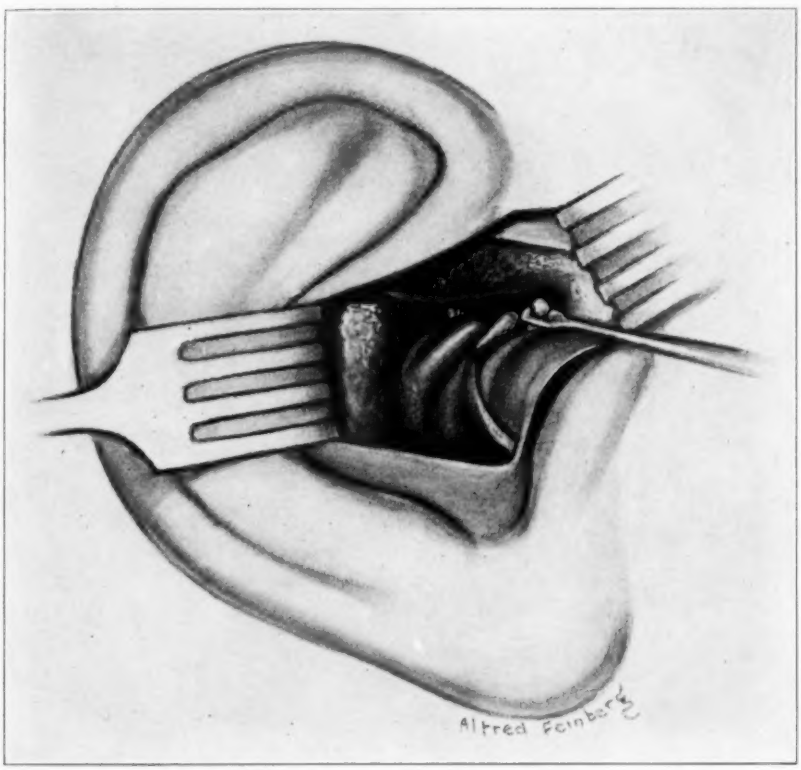

Fig. 15.—The liberation of the tympanic membrane from its anchorage to the ossicular chain, showing amputation with a specially devised guillotine of the head of the malleus at its point of junction with the neck of the malleus.

This is accomplished by resecting the head of the malleus. The incudomalleolar joint must be opened first, in order to resect the head of the malleus without disturbing the position of the incus. With a specially devised sharply pointed knife, the articular capsule which surrounds the incudomalleolar joint is gently incised and lifted to expose the articular cavity. The incudomalleolar joint is next divided, by introduction of the knife into the joint between the facets of the malleus and the incus and cautious working of the knife inward until the inner wall of the epitympanic recess is reached. By gentle moving of the

knife from above downward until the neck of the malleus is reached, the two facets are separated. Great caution must be exercised that the incus is not jolted, to insure against disturbing the incudostapedial joint. The superior ligament of the malleus, which descends from the roof of the epitympanic recess to the head of the malleus, is severed with the same knife. The lateral ligament of the malleus, which binds the head of the malleus to the posterior part of the notch of Rivinus,

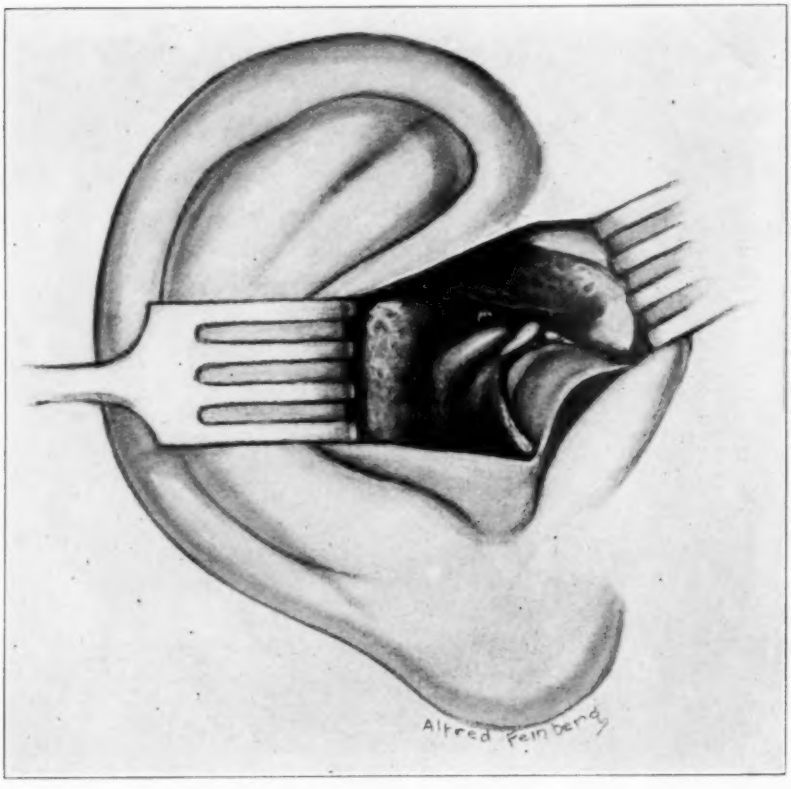

Fig. 16.—The liberation of the tympanic membrane from its anchorage to the ossicular chain after amputation and removal of the head of the malleus.

is severed, and the head of the malleus is gently pushed and displaced for a distance of 1 or 2 mm. in a direction anterior to the incus.

The malleus is engaged immediately below the head and at the beginning of its neck with a specially devised guillotine. The guillotine is held in one hand and steadied with the other, and the head of the malleus is amputated and removed. Great caution must be exercised in this part of the technic, because the slightest traction or jolting of the head of the malleus may result in a contracoup penetration and perforation of the tympanic membrane by the manubrium mallei.

The amputation and removal of the head of the malleus will serve later to permit the hermetic closure of the tympanic cavity and the exclusion of the epitympanic recess from the newly created auditory mechanism.

5. *Decompression of the Dura of the Temporal Lobe in the Region of the Epitympanic Recess.*—The inner bony table, which forms the roof of the epitympanic recess and is part of the floor of the middle fossa, first is skeletonized with a no. 2 round burr. When it becomes

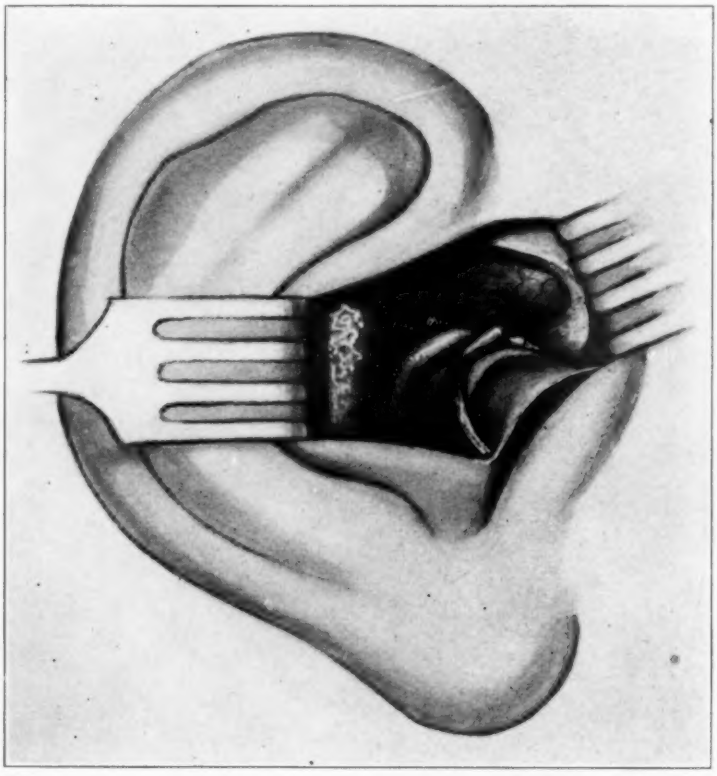

Fig. 17.—The decompression of the dura of the temporal lobe in the region of the epitympanic recess. The dural plate in the region of the epitympanic recess has been skeletonized, fractured and lifted away from the dura.

papyraceous, it is fractured and lifted away from the dura of the temporal lobe with a no. 1 curet. The temporal lobe is thus decompressed in the region of the tympanic cavity. The object of this surgical step is to relieve the perilabyrinthine venous stasis which has been suggested by Wittmaack [8] to be the cause of the pathogenesis in otosclerosis.

8. Wittmaack, K.: Die Ursache der Otosklerose: Ein Vorschlag zur ursächlichen Behandlung, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **129**:150 (June 26) 1931.

6. *The Excavation of a Troughlike Fenestra in the Bony Capsule of the External Horizontal Semicircular Canal, Down to the Perilymph Space.*—The troughlike fenestration of the external semicircular canal is an especially devised surgical means of mechanically preventing the eventual closure of the fenestra by regeneration of bone, which has defeated all former surgical efforts for the improvement of hearing.

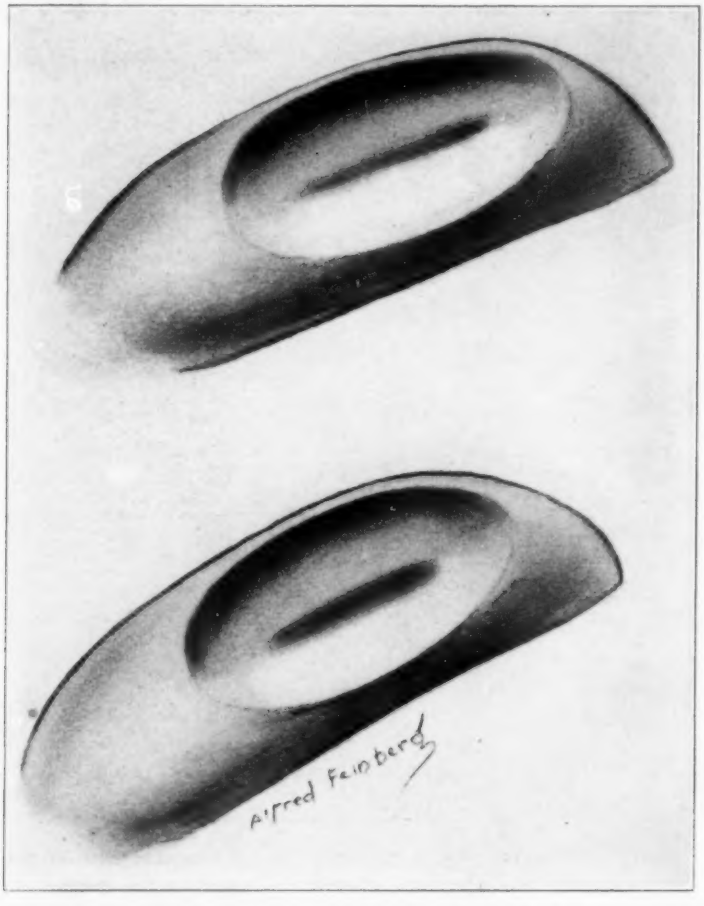

Fig. 18.—The excavation (stages 1 and 2) of a troughlike fenestra in the bony capsule of the external semicircular canal for the permanent mobilization of the labyrinthine perilymph, showing the excavated trough with its surrounding bony walls and skeletonized transparent bony floor, through which the lumen of the canal may be visualized.

This part of the surgical technic requires most delicate instrumentation and manipulation. It must be done carefully and slowly, under brilliant illumination and with the aid of extremely powerful magnify-

ing glasses. It must be accomplished without injury to the membranous labyrinth.

An electrically driven no. 2 round dental finishing or polishing burr, the width of whose circumference is about one-half that of the outer surface of the bony capsule of the external semicircular canal, is

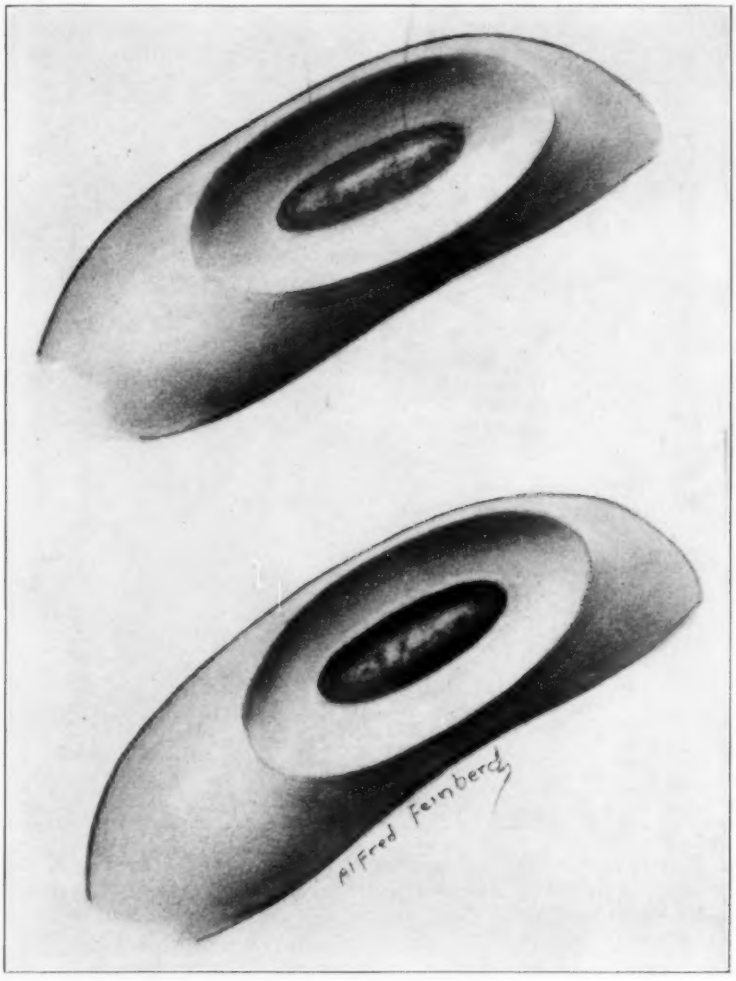

Fig. 19.—The excavation (stages 3 and 4) of a troughlike fenestra in the bony capsule of the external semicircular canal for the permanent mobilization of the labyrinthine perilymph. The upper drawing shows the excavated trough with its skeletonized transparent bony floor removed down to its endosteum; through this the membranous labyrinth can be visualized. The lower drawing shows the excavated trough with its endosteal floor removed and the perilymph space and the membranous labyrinth exposed.

employed for the excavation of the trough. The burr must be held in perfect control, and its excursions must be light and most carefully guided. The troughlike excavation should be begun on the outer surface of the bony capsule of the external semicircular canal, immediately below the ampulla, and should be extended for about 3 mm. along the longitudinal axis of the capsule and limited to the center of the width of the canal.

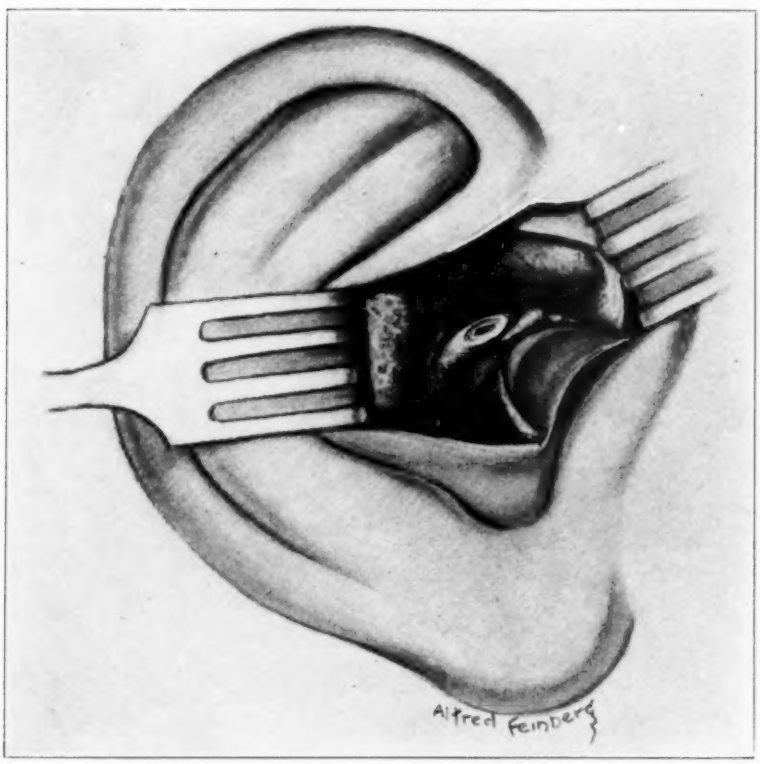

Fig. 20.—Completion of the excavation of a troughlike fenestra in the bony capsule of the external semicircular canal for the permanent mobilization of the labyrinthine perilymph.

This troughlike fenestra is created by several surgical stages.

1. Excavation of a troughlike groove with all its surrounding walls converging toward the bottom to meet its floor, which assumes the form of an extremely thin and transparent innermost periosteal layer of bone. Through this transparent floor the lumen of the external semicircular canal can be visualized in the form of a bluish gray line (under strong illumination and magnification).

2. Widening of the thin transparent bony floor at the bottom of the trough to permit visualization of the entire width of the lumen of the semicircular canal.

3. Careful polishing down of the bony floor of the trough, to remove the extremely thinned-out innermost periosteal layer of the bony capsule and the endochondral layer down to the endosteum. Through this extremely transparent endosteal floor the membranous labyrinth can now be visualized within the perilymph space in the lumen of the semicircular canal.

4. Gentle pulverizing of the extremely delicate endosteum, which forms the floor of the troughlike fenestra, with a few strokes of the polishing burr, until one or several microscopic drops of perilymph appear through the pores in the pulverized endosteum.

With the appearance of the first microscopic drop of perilymph, the patient complains of severe vertigo, and almost immediately a tremendous improvement in hearing manifests itself.

The lateral margins of the pulverized endosteal floor which cover the widest part of the perilymph space are now carefully removed with the lightest excursions of the burr. This results in an exposure of the widest portion of the perilymph space. With strong illumination and magnification, the intact membranous labyrinth, surrounded by pulsating perilymph, can now be seen.

When completed, the troughlike fenestra within the bony capsule of the external semicircular canal has slightly sloping bony walls extending from the wider aperture on the roof of the bony capsule to the narrower aperture in its floor, which communicates with the perilymph space. The walls surrounding this fenestra must maintain the original thickness of the bony capsule.

7. Final Liberation of the Tympanomeatal Cutaneous Membrane.—The meatal portion of the tympanomeatal cutaneous membrane, which was left attached temporarily to the inferior and anterior bony walls of the external auditory canal to protect it from accidental injury, is detached. An incision is made through the cutaneous lining of the anterior bony wall of the canal, beginning at the point of attachment of the tympanic membrane to the remaining superoanterior end of the sulcus tympanicus, and is carried outward and slightly downward along the entire superoanterior bony wall of the canal to its outermost margin. Another incision is made through the cutaneous lining of the posteroinferior bony wall of the canal, beginning at the point of attachment of the tympanic membrane to the remaining inferoposterior end of the sulcus tympanicus, and is carried outward and inclined somewhat downward along the entire posteroinferior bony wall of the canal to its outermost margin. A fine narrow periosteal elevator is inserted into

these incisions, and the still attached borders of the meatal portion of the tympanomeatal membrane are elevated from the underlying bony surfaces. This results in a complete severance of the meatal portion of the tympanomeatal membrane from its bony attachments, and there is completed a plastically constructed one piece tympanomeatal cutaneous membrane, attached only anteriorly and inferiorly to the anterior and the inferior wall of the sulcus tympanicus. This membrane is vascularized by the blood vessels of the membrana tympani.

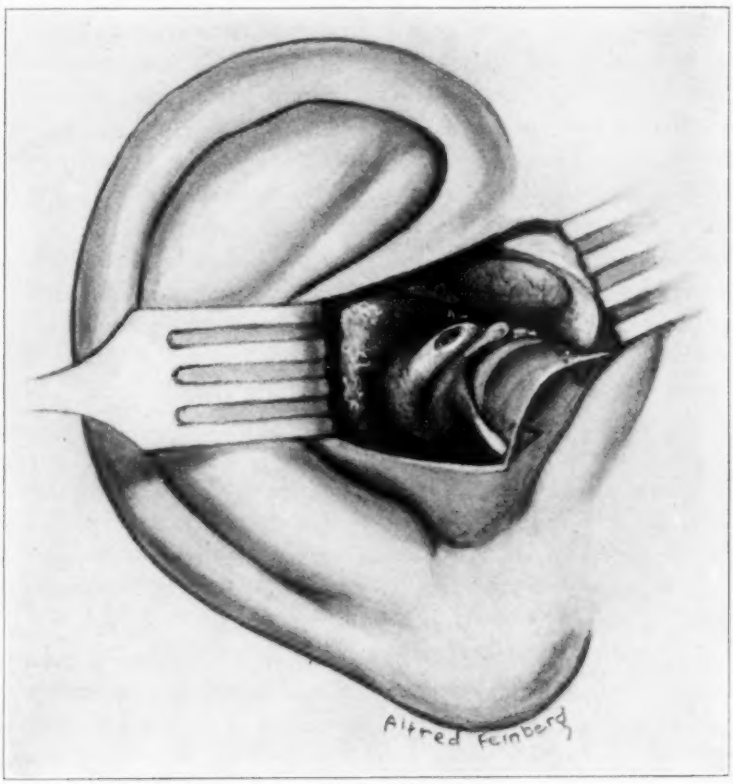

Fig. 21.—The final liberation of the meatal portion of the tympanomeatal cutaneous membrane from its attachments to the superoanterior and the posteroinferior bony wall of the external auditory canal.

8. *The Placement and Molding of the Tympanomeatal Cutaneous Membrane.*—The tympanomeatal cutaneous membrane, whose tympanic portion can now be made to extend superoposterior to the tympanic cavity, is gently stretched and placed so that the membrana tensa seals the tympanic cavity and covers the incus and the membrana flaccida covers the fenestra in the external semicircular canal. The remaining meatal portion of the tympanomeatal membrane covers the inner wall

of the epitympanic recess and the mastoid aspect of the basal labyrinthine portion of the petrous pyramid.

9. *Insertion of the Tympanomeatal Cutaneous Membrane into the Troughlike Fenestra of the External Semicircular Canal.*—A piece of paraffin mesh rolled into a small ball is placed over the portion of the tympanomeatal membrane which covers the outer aperture of the troughlike fenestra in the external semicircular canal. After gentle

Fig. 22.—The completely intact tympanomeatal cutaneous membrane placed in position. This membrane, properly placed, seals the tympanic cavity, covers the incus, is inserted into the troughlike fenestra, lines the inner surface of its bony walls, covers the floor of the trough, seals the perilymph space and lies in direct contact with the perilymph.

pressing and molding of the paraffin mesh over Shrapnell's membrane, the latter is inserted into the troughlike fenestra so as to line the inner surface of its walls, extend immediately beyond the edge of the inner aperture of the fenestra and lie in direct contact with the perilymph. The paraffin mesh ball is held in place by additional pieces of paraffin mesh inserted into the mastoid wound. On the care and precision

with which this step in the technic is carried out depends the permanent maintenance of the fenestra in the bony capsule. The insertion of Shrapnell's membrane into the troughlike fenestra in the manner described is another step in the mechanical prevention of closure of the fenestra by regeneration of bone.

A mastoid dressing and bandage applied in the routine fashion completes the operation.

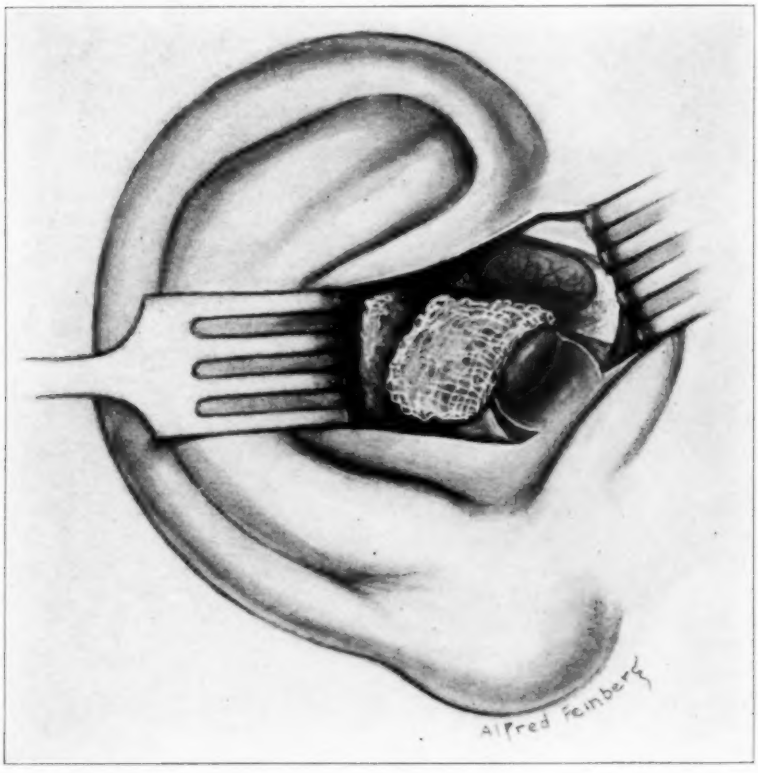

Fig. 23.—Molding and maintenance of the membrane in final position with paraffin mesh.

Postoperative Care of Wound.—The superficial dressing is changed daily. On the eighth postoperative day the first full dressing is made. At this time the paraffin mesh is gently removed, care being taken not to disturb the flap. All secretions within the mastoidomeatal wound are wiped and dried with sterile cotton applicators. After the dressing is completed a piece of sterile cotton is placed in front of the entrance to the external auditory canal. The superficial bandage is discarded after the first deep dressing.

Thereafter, the mastoidomeatal wound is dressed every other day until complete epidermization of the wound has taken place.

Indications.—Technic described for the improvement of hearing may be employed with good results when there exist:

1. Clinical evidence of fixation of the stapes.
2. Loss of hearing by air conduction of not more than 60 per cent (if practical improvement in hearing sufficient to permit the patient to resume his economic and social life is to be obtained).
3. Loss of hearing by air conduction of not less than 40 per cent, when accompanied with a loss of practical hearing.
4. Normal hearing by bone conduction determined by masking or a loss in hearing by bone conduction, determined by masking, which does not exceed 30 decibels for the 512, 1024 and 2048 frequencies.
5. A complete absence of suppuration from the middle ear.
6. A completely normal and translucent membrana tympani without perforations.
7. A completely intact and healthy cutaneous lining of the bony walls of the external auditory canal.
8. A normal state of health.

REPORT OF CASES

CASE 1.—A woman aged 44, an office worker, first noted a disturbance in hearing twenty years before examination. In 1931 there was a definite loss in hearing acuity, more marked in the left ear. After a mental upset in 1923, the hearing became much worse, and this condition progressed thereafter. No form of treatment had been of any avail. One aunt and one cousin were hard of hearing.

A preoperative hearing test (air conduction) on Nov. 11, 1937, showed a 57½ per cent loss in the right ear and a 76½ per cent loss in the left ear.

On Dec. 28, 1937, the Lempert operation was performed on the left ear.

Postoperative hearing tests gave the following results:

	Loss in right ear (percentage)	Loss in left ear (percentage)
Dec. 31, 1937	61	56
Jan. 9, 1938	48	49
Jan. 26, 1938	51	80
Feb. 2, 1938	58	61
Feb. 10, 1938	65	74
March 2, 1938	58	73
March 29, 1938	Bone conduction test showed none on left side	

Comment: Preoperatively this patient was never tested for bone conduction. She was an unsuitable subject because of the nerve deafness which was discovered postoperatively. The fistula closed within three weeks.

On May 14, 1938, a fistula test gave negative results. The improvement in hearing had been lost.

CASE 2.—A woman aged 37, a housewife, first noticed loss of hearing in 1923. The condition improved gradually until after an operation on the left side of the nose in 1925, when she lost all practical hearing in the left ear; the hearing in the right ear was affected. The condition became progressively worse thereafter. There was no deafness in the family.

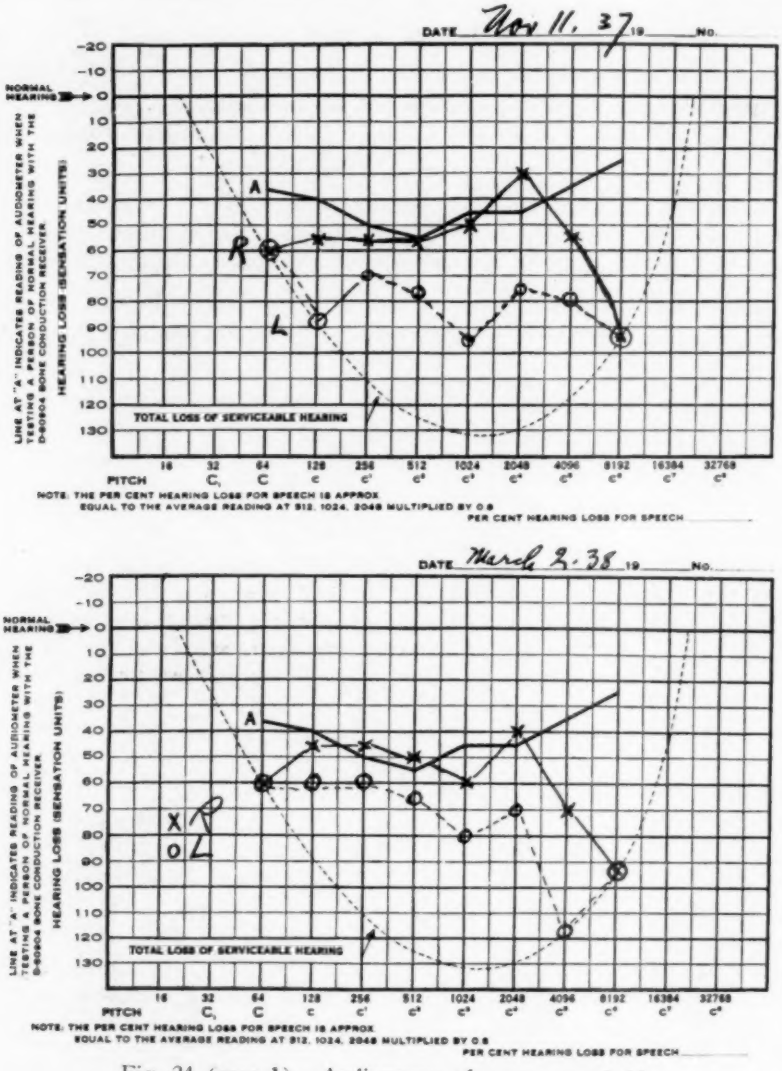
DATE Nov 11, 37 19 NO.
NORMAL HEARING
LINE AT "A" INDICATES READING OF AUDIOMETER WHEN TESTING A PERSON OF NORMAL HEARING WITH THE D-60804 BONE CONDUCTION RECEIVER
HEARING LOSS (SENSATION UNITS)
-20 -10 0 10 20 30 40 50 60 70 80 90 100 110 120 130
A
R
L
TOTAL LOSS OF SERVICEABLE HEARING
16 32 64 128 256 512 1024 2048 4096 8192 16384 32768
PITCH C, C c c' c² c³ c⁴ c⁵ c⁶ c⁷ c⁸
NOTE: THE PER CENT HEARING LOSS FOR SPEECH IS APPROX. EQUAL TO THE AVERAGE READING AT 512, 1024, 2048 MULTIPLIED BY 0.6
PER CENT HEARING LOSS FOR SPEECH
DATE March 2, 38 19 NO.
NORMAL HEARING
LINE AT "A" INDICATES READING OF AUDIOMETER WHEN TESTING A PERSON OF NORMAL HEARING WITH THE D-60804 BONE CONDUCTION RECEIVER
HEARING LOSS (SENSATION UNITS)
-20 -10 0 10 20 30 40 50 60 70 80 90 100 110 120 130
A
X R
O L
TOTAL LOSS OF SERVICEABLE HEARING
16 32 64 128 256 512 1024 2048 4096 8192 16384 32768
PITCH C, C c c' c² c³ c⁴ c⁵ c⁶ c⁷ c⁸
NOTE: THE PER CENT HEARING LOSS FOR SPEECH IS APPROX. EQUAL TO THE AVERAGE READING AT 512, 1024, 2048 MULTIPLIED BY 0.6
PER CENT HEARING LOSS FOR SPEECH

Fig. 24 (case 1).—Audiograms of woman aged 44.

A preoperative hearing test (air conduction) on Sept. 23, 1937, showed a 52 per cent loss in the right ear and a 60 per cent loss in the left ear.

On Jan. 8, 1938, the Lempert operation was performed on the left ear.

A postoperative hearing test (air conduction) on April 16, 1938, showed a 45¼ per cent loss in the right ear and a 30⅛ per cent loss in the left ear.

Comment: There was no temporary reduction in hearing postoperatively in this case. On May 14, 1938, a fistula test gave strongly positive results. The improvement in hearing had been maintained.

CASE 3.—An unemployed man aged 32 complained of a progressive loss in hearing for seven years. An intranasal operation had been performed for the

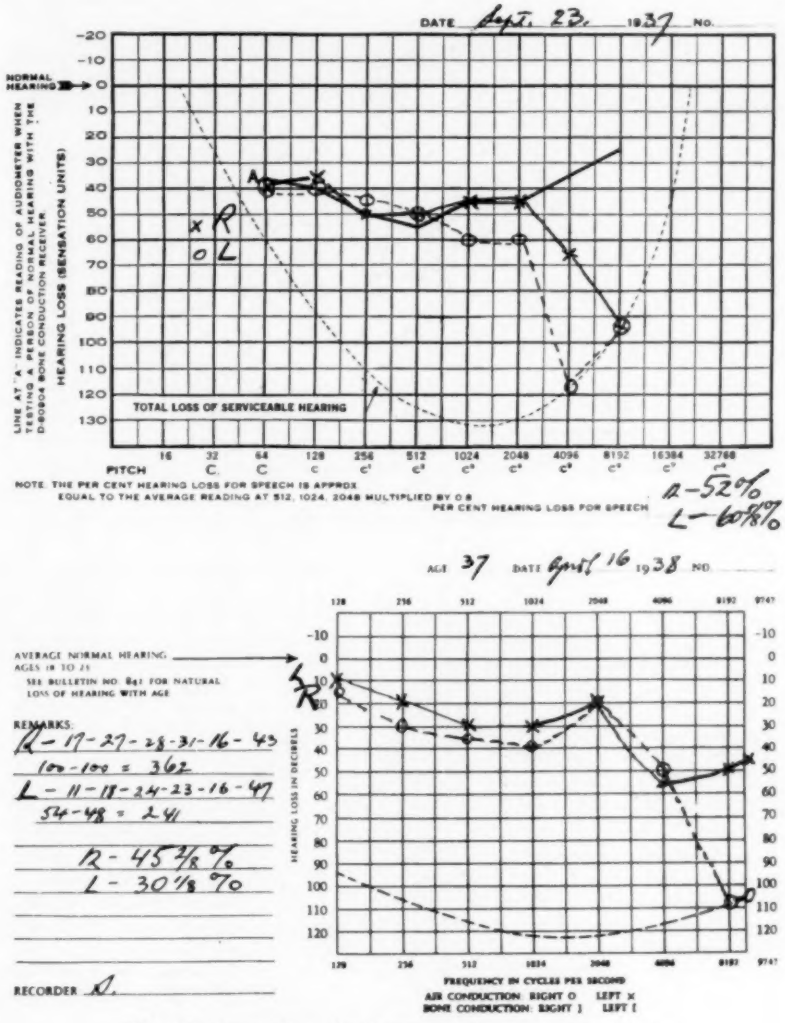
DATE Sept. 23. 1937 NO.
NORMAL HEARING
HEARING LOSS (SENSATION UNITS)
TOTAL LOSS OF SERVICEABLE HEARING
PITCH
NOTE. THE PER CENT HEARING LOSS FOR SPEECH IS APPROX. EQUAL TO THE AVERAGE READING AT 512, 1024, 2048 MULTIPLIED BY 0.8
PER CENT HEARING LOSS FOR SPEECH
R-52%
L-60%
AGE 37 DATE April 16 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
REMARKS:
R - 17-27-28-31-16-43
100-100 = 362
L - 11-18-24-23-16-47
54-48 = 241
R - 45 3/8 %
L - 30 1/8 %
RECORDER
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [

Fig. 25 (case 2).—Audiograms of woman aged 37.

relief of the impediment. There had been no tinnitus or otitic infection. The drum was intact. The patient used a hearing aid. One brother was hard of hearing.

A preoperative hearing test (air conduction) on Feb. 4, 1938, showed a 70⅛ per cent loss in the right ear and a 73⅛ per cent loss in the left ear.

On Feb. 9, 1938, the Lempert operation was performed on the right ear.

A postoperative hearing test (air conduction) on April 23, 1938, showed a 48⅜ per cent loss in the right ear and a 65⅞ per cent loss in the left ear.

Comment: There was no response at the time of operation, and the operation was believed to be a failure because of the marked loss in air conduction. Ten days postoperatively the patient stated that he heard less than before operation, but on the following day he began to hear sounds again. The reason for this

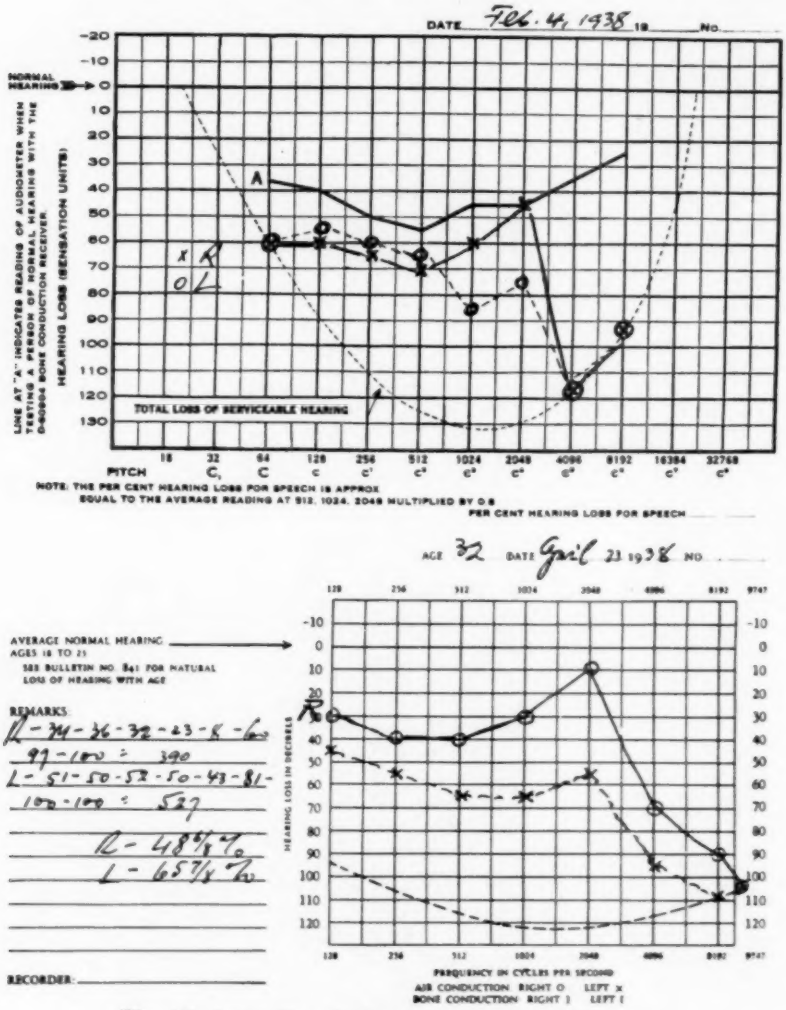
DATE Feb. 4, 1938
NORMAL HEARING
HEARING LOSS (SENSATION UNITS)
TOTAL LOSS OF SERVICEABLE HEARING
PITCH
PER CENT HEARING LOSS FOR SPEECH
AGE 32 DATE April 23 1938
AVERAGE NORMAL HEARING AGES 18 TO 25
REMARKS
R - 34 - 36 - 32 - 43 - 8 - 6
97 - 100 = 390
L - 51 - 50 - 52 - 50 - 43 - 81 -
100 - 100 = 527
R - 48⅜%
L - 65⅞%
RECORDER
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION RIGHT O LEFT x
BONE CONDUCTION RIGHT] LEFT [

Fig. 26 (case 3).—Audiograms of man aged 32.

temporary loss in hearing was the presence of a postoperative hemorrhage into the tympanic cavity and into the entire mastoid wound and canal. As soon as the hemorrhage was absorbed the hearing improved. The patient stated that the improvement in his hearing was so great that he was able to return to his former occupation, that of salesman, and that for his practical purposes he could hear almost normally. At his last visit to the office, he called the attention of

my secretary to the birds chirping outside the window. The fistula had remained patent. On May 14, 1938, a fistula test gave strongly positive results; the improvement in hearing had been maintained.

CASE 4.—A woman aged 46, a housewife, first noted hardness of hearing after the birth of her first child, twenty-nine years before. A further decrease in

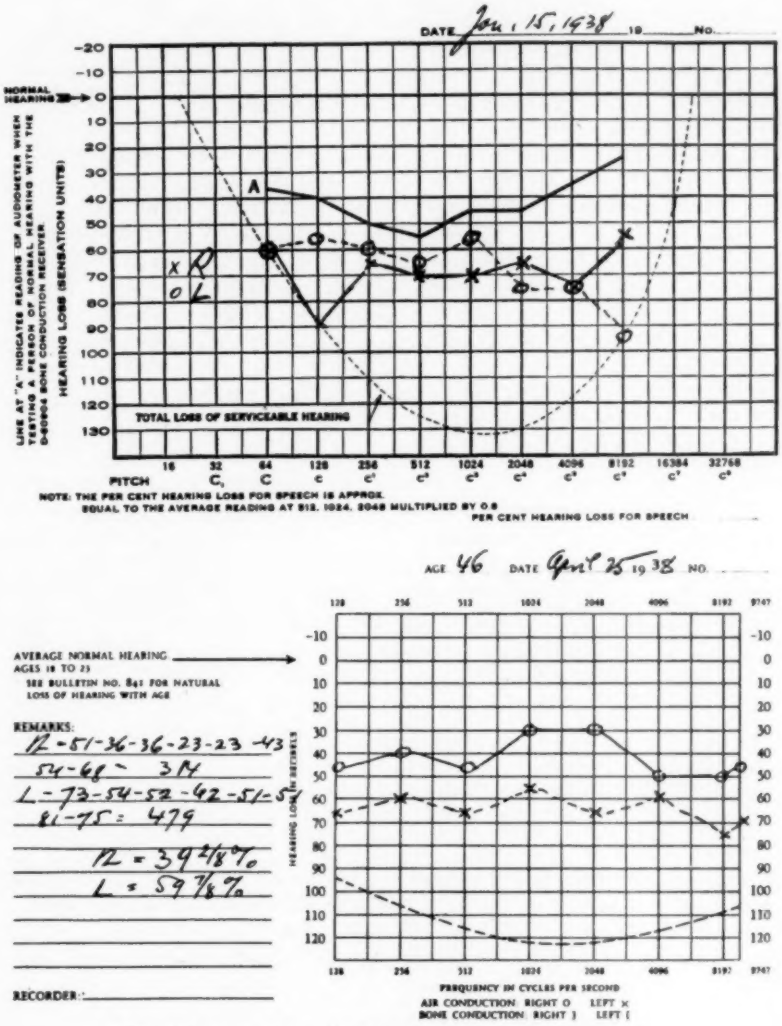

Fig. 27 (case 4).—Audiograms of woman aged 46.

hearing followed the birth of each of her other three children. She had no tinnitus, and there had been no deafness in the family.

Preoperative hearing tests on Jan. 15, 1938, showed, by air conduction, a 68 per cent loss in the right ear and the left ear; by bone conduction hearing was within indicated limits.

On Feb. 10, 1938, the Lempert operation was performed on the right ear. Considerable difficulty was encountered in the removal of the head of the malleus, but this was finally accomplished with an aural snare. Rupture of the drum extending the length of the hammer handle resulted.

After operation the hearing was excellent and remained so for three days. From then on until the dressing on the eighth day, there was a recession in the improvement, but the hearing capacity was still increased over that possessed preoperatively. At the first dressing the handle of the malleus was seen to protrude through the drum. The part of the manubrium mallei which was protruding was amputated with narrow pointed scissors. The mucoid discharge from the middle ear interfered with the acuity of hearing, but as soon as this cleared and the perforation healed, the improvement in hearing was reestablished.

A postoperative hearing test (air conduction) on April 25, 1938, showed a 38⅞ per cent loss in the right ear and 59⅞ per cent loss in the left ear.

Comment: The patient's hearing improved markedly until April 5, when acute influenza, tonsillitis and abscess of the middle ear developed. The suppurative otitis media perforated the drum, and the hearing immediately dropped to the preoperative level. This condition lasted for ten days, after which resolution set in and there was a return of the improvement in hearing to the degree noted postoperatively.

This case suggests that the improvement in hearing following opening of the semicircular canal was due to an improvement in the mechanism of air conduction. When the air conduction was impaired by a suppurative process in the middle ear, in spite of the fact that the fistula remained open, hearing was impaired.

This case further illustrates the fact that the occurrence of suppuration in a tympanic cavity which has been shut off from the epitympanic recess and the rest of the mastoid process by the performance of the primary steps in the operation does not necessarily imply that a suppurative labyrinthitis will develop.

At no time was any thickening or inflammatory reaction of the membrane sealing the labyrinthine fenestra noted.

On May 14, 1938, the fistula test gave a strongly positive result; improvement in hearing had been maintained. At this writing the ear is dry, and the fistula is open.

CASE 5.—A man aged 25, a sign painter, complained of progressive loss in hearing for sixteen years. One year after the onset of this condition, the patient had meningococcic meningitis. There was no tinnitus, and there had been no deafness in the family.

Preoperative hearing tests on Feb. 8, 1938, showed, by air conduction, a 49 per cent loss in the right ear and a 37 per cent loss in the left ear; by bone conduction hearing was within normal indicated limits.

On Feb. 11, 1938, the Lempert operation was performed on the right ear.

Postoperative hearing tests on April 27, 1938, showed, by air conduction, a 30½ per cent loss in the right ear and a 35⅛ per cent loss in the left ear; by bone conduction hearing was normal throughout.

Comment: The patient regained practical hearing, was able to hear whispers and to hear in the movies and was no longer aware of any handicap. On May 14, 1938, a fistula test gave strongly positive results; the gain in hearing had been maintained.

CASE 6.—A man aged 23, a shipping clerk, noted a gradual loss in hearing in both ears for one and one-half years. There had been no otitic infection or familial deafness, but there was tinnitus.

Preoperative hearing tests on Feb. 5, 1938, showed, by air conduction, a 42 per cent loss in the right ear and a 50 per cent loss in the left ear; bone conduction hearing was below the normal indicated limits.

On Feb. 13, 1938, the Lempert operation was performed on the right ear. No improvement in hearing was noted at the time.

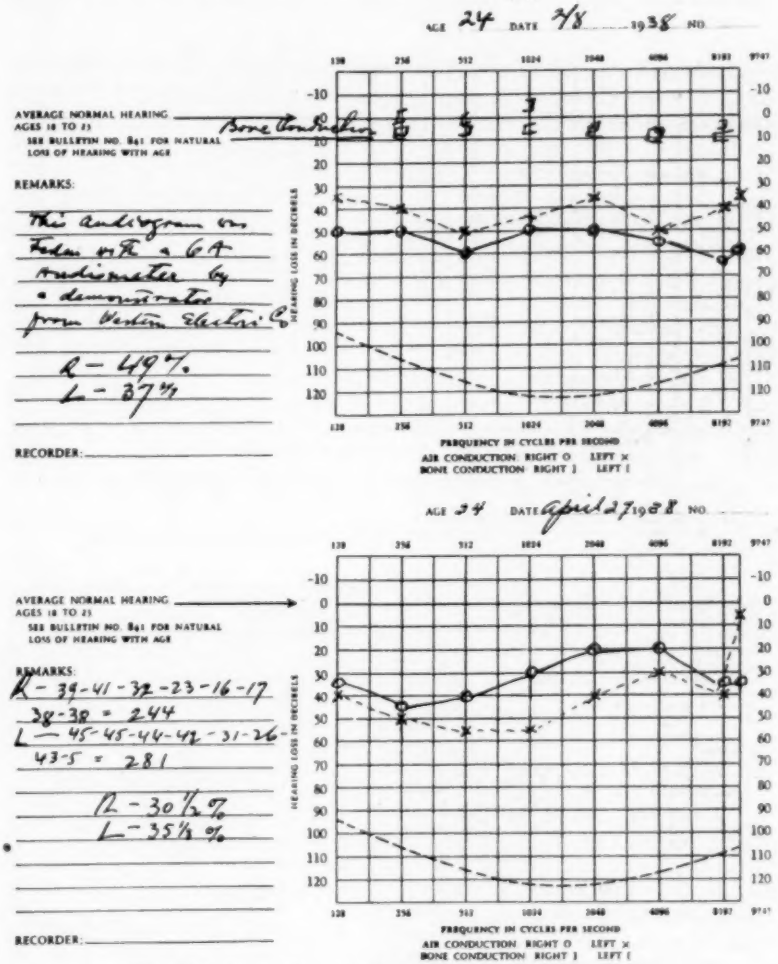
AGE 24 DATE 2/8 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 23
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
This audiogram was taken with a 6A audiometer by a demonstrator from Western Electric Co
R - 49%
L - 37½
RECORDER:
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION RIGHT O LEFT X
BONE CONDUCTION RIGHT] LEFT [
AGE 24 DATE April 27 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 23
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 39-41-32-23-16-17
28-38 = 244
L - 45-45-44-42-31-26
43-5 = 281
R - 30½%
L - 35½%
RECORDER:
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION RIGHT O LEFT X
BONE CONDUCTION RIGHT] LEFT [

Fig. 28 (case 5).—Audiograms of man aged 25.

These findings regarding air and bone conduction are significant in the face of a persistent positive reaction to the fistula test on the operated ear.

On Feb. 28, 1938, the Lempert operation was performed on the left ear, in spite of the poor result obtained at the first operation, because the patient and his family insisted that this be done. No hearing was noted while the patient was on the table.

A postoperative hearing test (air conduction) on March 2, 1938, showed an 80 per cent loss in the right ear and a 50 per cent loss in the left ear; another test (bone conduction) on March 15, 1938, showed, for the right ear, bone con-

duction lost for all tones except 1024 double vibrations (50 decibel loss); for the left ear, hearing was the same as it had been preoperatively.

Comment: No improvement in hearing for practical use resulted, and the tinnitus persisted. The patient was not considered a suitable subject for operation. On May 14, 1938, a fistula test of both ears gave strongly positive results, and both fistulas were open at the time this report was made.

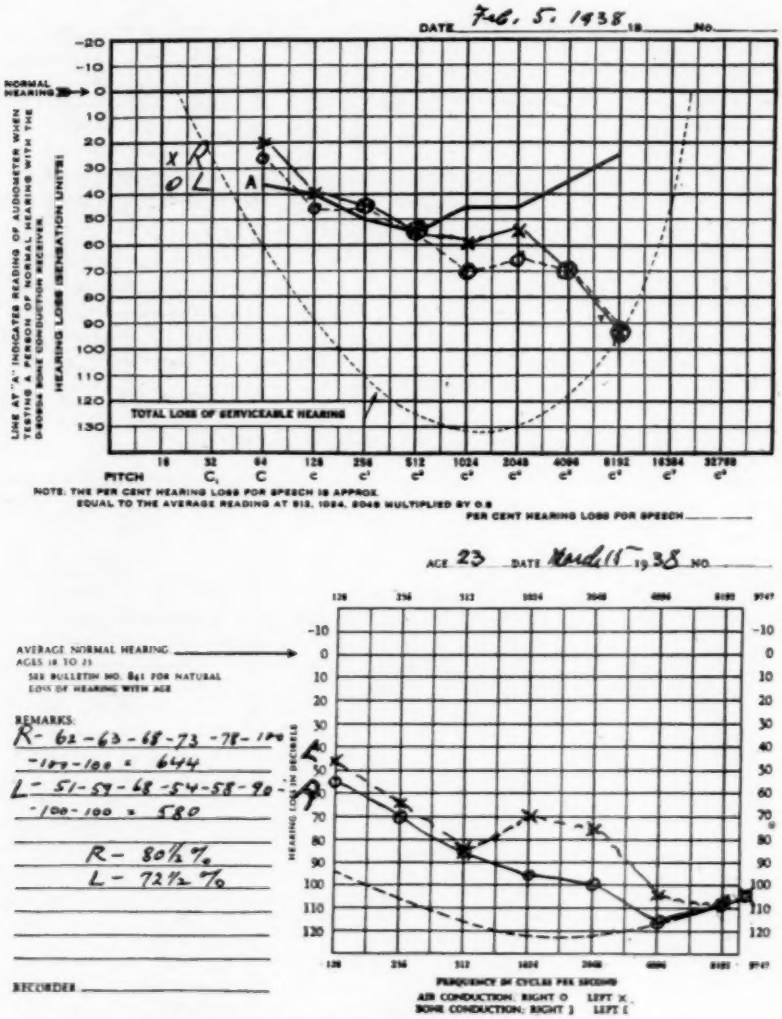

Fig. 29 (case 6).—Audiograms of man aged 23.

CASE 7.—A woman aged 47, a housewife, had been hard of hearing since she was 13, the left ear being worse than the right. There had never been any tinnitus or otorrhea.

Preoperative hearing tests on Feb. 10, 1938, showed, by air induction, a 76 per cent loss in the right ear and a 68 per cent loss in the left ear; bone conduction hearing was within normal indicated limits.

On Feb. 16, 1938, the Lempert operation was performed on the right ear.

A postoperative hearing test (air conduction) on April 19, 1938, showed a 43 per cent loss in the right ear and a 60⅜ per cent loss in the left ear.

Comment: There was no temporary reduction in hearing in this case. On May 14, 1938, a fistula test gave strongly positive results. The gain had been maintained, and hearing was normal for practical use.

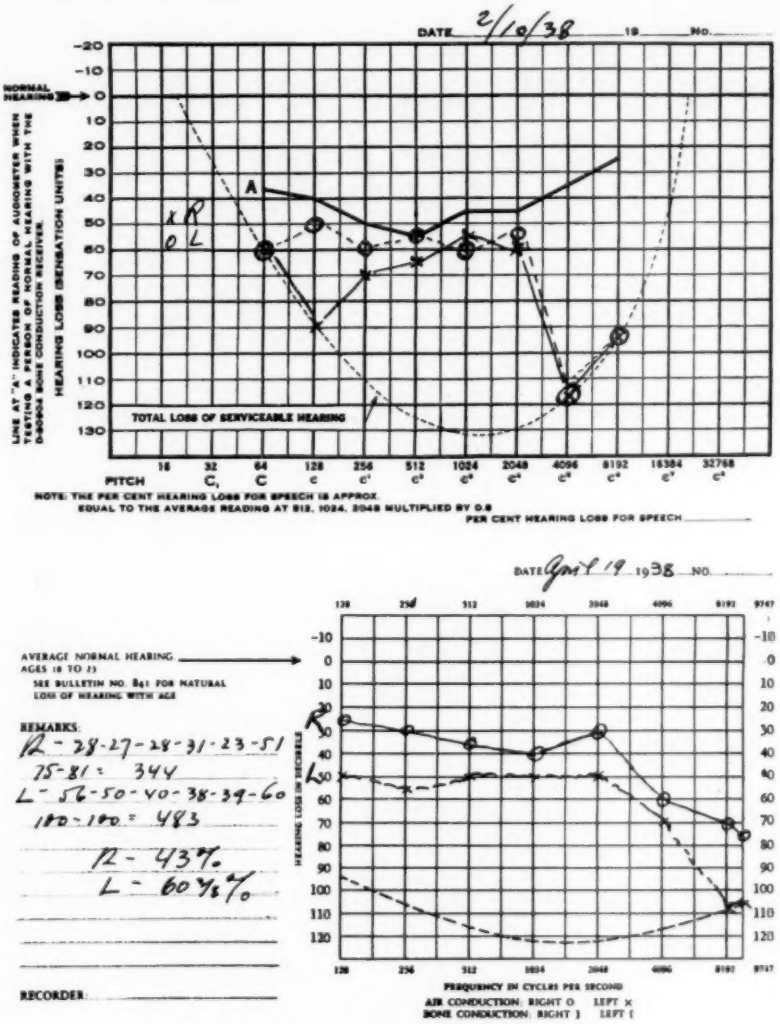
DATE 2/10/38
NORMAL HEARING
HEARING LOSS (SENSATION UNITS)
TOTAL LOSS OF SERVICEABLE HEARING
PITCH
NOTE: THE PER CENT HEARING LOSS FOR SPEECH IS APPROX.
EQUAL TO THE AVERAGE READING AT 512, 1024, 2048 MULTIPLIED BY 0.8
PER CENT HEARING LOSS FOR SPEECH
DATE April 19 1938 NO.
AVERAGE NORMAL HEARING
AGES 19 TO 23
SEE BULLETIN NO. 841 FOR NATURAL
LOSS OF HEARING WITH AGE
REMARKS:
R - 28-27-28-31-23-51
75-81 = 344
L - 56-50-40-38-39-60
100-100 = 483
R - 43%
L - 60⅜%
RECORDER
PERCENT OF LOSS HEARING
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [

Fig. 30 (case 7).—Audiograms of woman aged 47.

CASE 8.—A woman aged 40, a secretary, had noticed a gradual and progressive loss in hearing for fifteen years. There had been an abscess in the right ear several years before examination, and severe tinnitus had developed two years before. Because of this impediment in hearing the patient had lost her position.

Preoperative hearing tests on Feb. 18, 1938, showed, by air conduction, a 47 per cent loss in the right ear and a 52 per cent loss in the left ear; by bone conduction hearing was within the normal indicated limits.

On Feb. 25, 1938, the Lempert operation was performed on the left ear. The hearing was excellent at the time; the improvement persisted for two days,

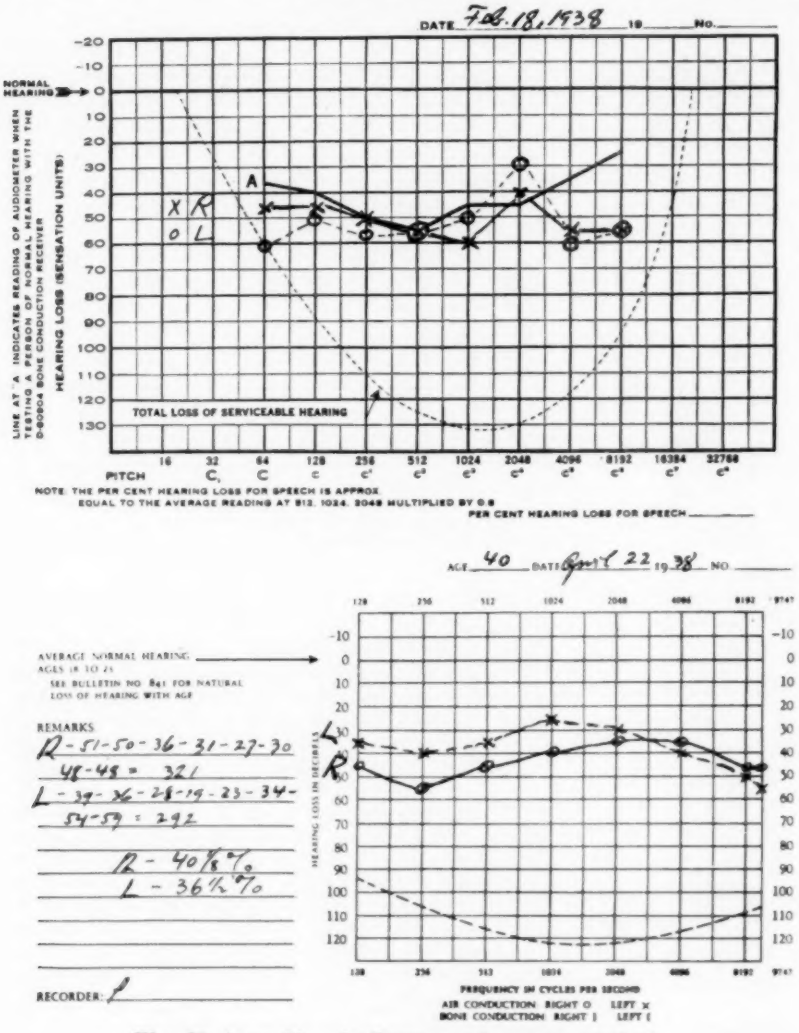
DATE Feb. 18, 1938 19 NO.
NORMAL HEARING
HEARING LOSS (SENSATION UNITS)
TOTAL LOSS OF SERVICEABLE HEARING
PITCH
NOTE: THE PER CENT HEARING LOSS FOR SPEECH IS APPROX. EQUAL TO THE AVERAGE READING AT 512, 1024, 2048 MULTIPLIED BY 0.8
PER CENT HEARING LOSS FOR SPEECH
AGE 40 DATE April 22 19 38 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS
R - 51-50-36-31-27-30
48-48 = 321
L - 39-36-28-19-23-34-
54-54 = 292
R - 40⅛%
L - 36½%
RECORDER:
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT x
BONE CONDUCTION: RIGHT] LEFT [

Fig. 31 (case 8).—Audiograms of woman aged 40.

and then hearing returned to the preoperative level. No fistula test was obtainable at the first dressing on the eighth day. The tinnitus persisted.

A postoperative hearing test (air conduction) on April 22, 1938, showed a 40⅛ per cent loss in the right ear and a 36½ per cent loss in the left ear.

Comment: On May 14, 1938, a fistula test gave strongly positive results. Hearing for practical purposes and by audiometric test was satisfactory, and the gain in hearing was maintained.

CASE 9.—A woman aged 34, a housewife, first noted a loss in hearing, most marked in the right ear, and a throbbing sensation in the right ear after childbirth, five years before examination. The condition had become progressively worse. The mother, the maternal grandmother and 2 cousins were deaf.

Preoperative hearing tests on March 10, 1938, showed, by air conduction, a 44½ per cent loss in the right ear and a 40⅞ per cent loss in the left ear; by bone conduction hearing was within normal indicated limits.

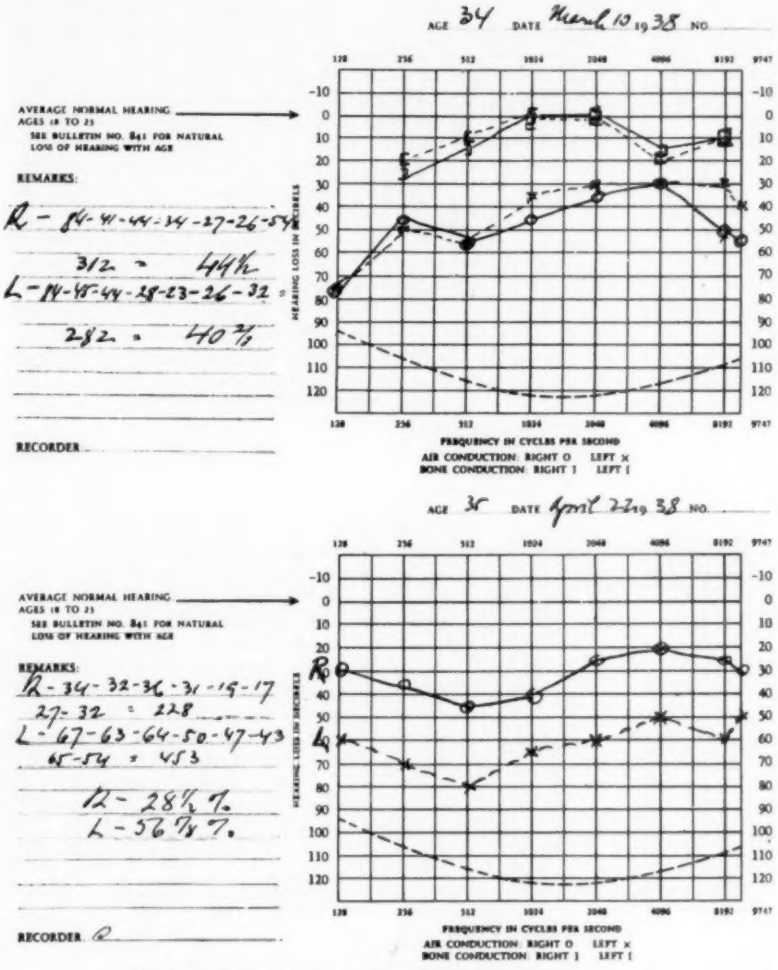
AGE 34 DATE March 10 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 84-41-44-34-27-26-54
312 = 44¼
L - 74-48-44-28-23-26-32 =
282 = 40⅞
RECORDER
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [
AGE 35 DATE April 22 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 34-32-36-31-15-17
27-32 = 228
L - 67-63-64-50-47-43
65-54 = 453
R - 28½ %
L - 56⅞ %
RECORDER
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [

Fig. 32 (case 9).—Audiograms of woman aged 34.

On March 11, 1938, the Lempert operation was performed on the right ear. The mastoid cavity was extremely small, so that the meatal portion of the tympanomeatal cutaneous membrane was too long for use. It was applied, nevertheless, so as to extend and cover Trautmann's triangle. During the postoperative treatment, the distal portion of the membrane lying posterior to the external semicircular canal sloughed and had to be removed.

A postoperative hearing test (air conduction) on April 22, 1938, showed a 28½ per cent loss in the right ear and a 56⅝ per cent loss in the left ear.

Comment: Practical hearing in this case was markedly improved. The fistula remained patent. On May 14, 1938, a fistula test gave strongly positive results; the improvement in hearing had been maintained.

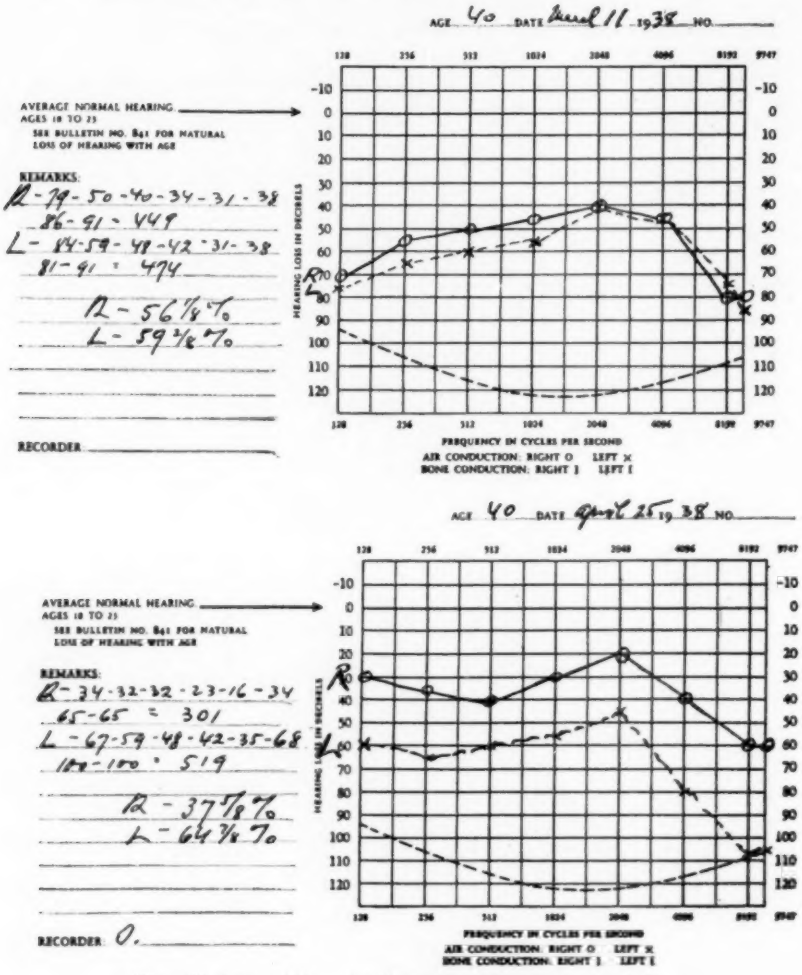
AGE 40 DATE March 11 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 79 - 50 - 40 - 34 - 31 - 38
86 - 91 = 449
L - 84 - 59 - 48 - 42 - 31 - 38
81 - 91 = 474
R - 56⅛%
L - 59⅜%
RECORDER
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [
AGE 40 DATE April 25 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 34 - 32 - 32 - 23 - 16 - 34
65 - 65 = 301
L - 67 - 59 - 48 - 42 - 35 - 68
100 - 100 = 519
R - 37⅞%
L - 64⅞%
RECORDER O.
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [

Fig. 33 (case 10).—Audiograms of woman aged 40.

CASE 10.—A woman aged 40, a designer, while still at high school, had noted that she was losing her hearing. She had always been subject to many colds and had been treated for sinal trouble. Tonsillectomy had been done during early youth. Tinnitus set in, and the hearing became progressively worse. Her father was hard of hearing. Four weeks prior to operation for the relief of deafness, the patient sustained a fracture of the tenth rib.

Preoperative hearing tests (air conduction) on March 11, 1938, showed a 56 per cent loss in the right ear and a 59 per cent loss in the left ear; by bone conduction hearing was within normal indicated limits.

On March 14, 1938, the Lempert operation was performed on the right ear. Good hearing resulted at the time.

A postoperative hearing test (air conduction) on April 25, 1938, showed a 37⅝ per cent loss in the right ear and a 64⅞ per cent loss in the left ear.

Comment: There was a temporary reduction in hearing on the second postoperative day, which lasted for four or five days. This was due to a marked reaction in the tympanic cavity caused by the accumulation of blood. As soon

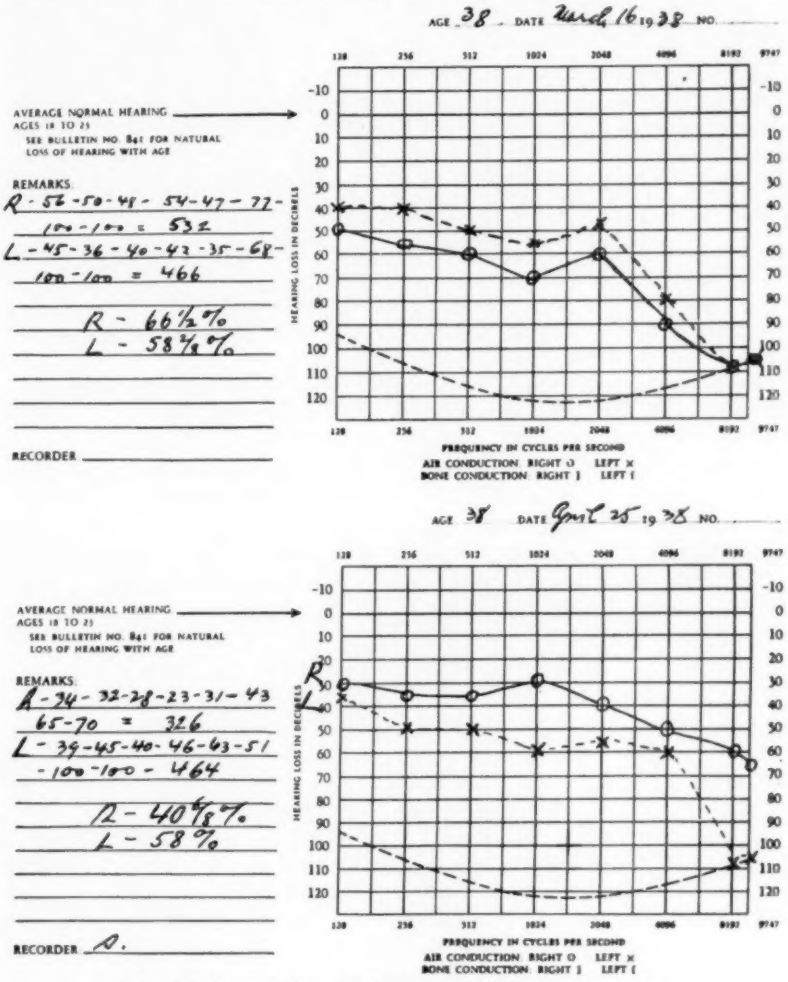
AGE 38 DATE March 16 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS
R - 52 - 50 - 48 - 54 - 47 - 77 - 100 - 100 = 532
L - 45 - 36 - 40 - 42 - 35 - 68 - 100 - 100 = 466
R - 66½%
L - 58⅛%
RECORDER
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION RIGHT O LEFT X
BONE CONDUCTION RIGHT] LEFT [
AGE 38 DATE April 25 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS
R - 34 - 32 - 28 - 23 - 31 - 43 - 65 - 70 = 326
L - 39 - 45 - 40 - 46 - 63 - 51 - 100 - 100 = 464
R - 40⅝%
L - 58%
RECORDER A.
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION RIGHT O LEFT X
BONE CONDUCTION RIGHT] LEFT [

Fig. 34 (case 11).—Audiograms of woman aged 37.

as the reaction began to subside, improvement in hearing returned and continued thereafter.

On May 14, 1938, a fistula test gave strongly positive results. The gain in hearing had been maintained. Today the patient has good practical hearing and a functioning fistula.

CASE 11.—A woman aged 37, a housewife, had a progressive loss in hearing following a cold sixteen years before examination. She complained of severe

tinnitus. There was no otitic infection. A mother and sister were hard of hearing. The patient had had a pulmonary infection, but all examinations failed to show any evidence of tuberculosis. The patient used a hearing aid but experienced difficulty with it.

Preoperative hearing tests on March 16, 1938, showed, by air conduction, a 66 per cent loss in the right ear and a 58 per cent loss in the left ear; by bone conduction hearing was within normal indicated limits.

On March 23, 1938, the Lempert operation was performed on the right ear. Hearing at the time was excellent.

A postoperative hearing test (air conduction) on April 25, 1938, showed a 40⅝ per cent loss in the right ear and a 58 per cent loss in the left ear.

Comment: Tinnitus persisted. The patient discarded her hearing aid and for practical purposes heard well.

On May 14, 1938, a fistula test gave strongly positive results. The gain in hearing had been maintained. The fistula has remained open.

CASE 12.—A woman aged 32, a social worker, had undergone right mastoidectomy at the New York Eye and Ear Infirmary twenty-two years before examination. Two revisions were performed at the same institution. After that there was a gradual loss in hearing in both ears. Tinnitus was persistent. The patient used a hearing aid but could not hear with it.

Preoperative hearing tests on Feb. 18, 1938, showed, by air conduction, a 70 per cent loss in the right ear and a 76 per cent loss in the left ear; by bone conduction hearing was within normal indicated limits.

On March 24, 1938, the Lempert operation was performed on the left ear. Marked improvement in hearing was observed at the time.

A postoperative hearing test (air conduction) on April 22, 1938, showed a 63½ per cent loss in the right ear and a 49⅞ per cent loss in the left ear.

Comment: The tinnitus, which was marked before operation, completely disappeared. The patient heard well enough to be able to seek employment and no longer needed a hearing aid. On May 14, 1938, a fistula test gave strongly positive results. The improvement in hearing had been maintained.

CASE 13.—A woman aged 38, a bookkeeper, attributed her deafness to an acute accident twelve years before examination. Since then there had been a progressive loss in hearing in both ears and marked tinnitus. The patient used a hearing aid for the left ear but could not hear well with it. She was unable to hear with or without a hearing aid with the right ear.

Preoperative hearing tests on March 12, 1938, showed, by air conduction, a 75 per cent loss in the right ear and a 64 per cent loss in the left ear; by bone conduction hearing was within normal indicated limits.

On March 25, 1938, the Lempert operation was performed on the right ear. A marked improvement in hearing was observed at the time.

A postoperative hearing test (air conduction) on April 12, 1938, showed a 55½ per cent loss in the right ear and a 55⅝ per cent loss in the left ear.

Comment: The patient reported that she could hear with the ear which had been operated on. When she put the telephone receiver to the other ear she did not hear but was able to hear with the one operated on. Improvement, according to the audiometric test, was equally marked in the two ears after operation. Tinnitus disappeared in the right ear and became much milder in the left ear. On May 14, 1938, a fistula test gave strongly positive results. The gain in hearing had been maintained.

CASE 14.—A man aged 26, a hair dresser, had had marked tinnitus in both ears for five years. After inflation of the eustachian tube he suddenly became deaf. He was unable to hear even shouting after that. His sister and father were hard of hearing.

A preoperative hearing test (air conduction) on Jan. 7, 1937, showed an 88 per cent loss in the right ear and a 75 per cent loss in the left ear.

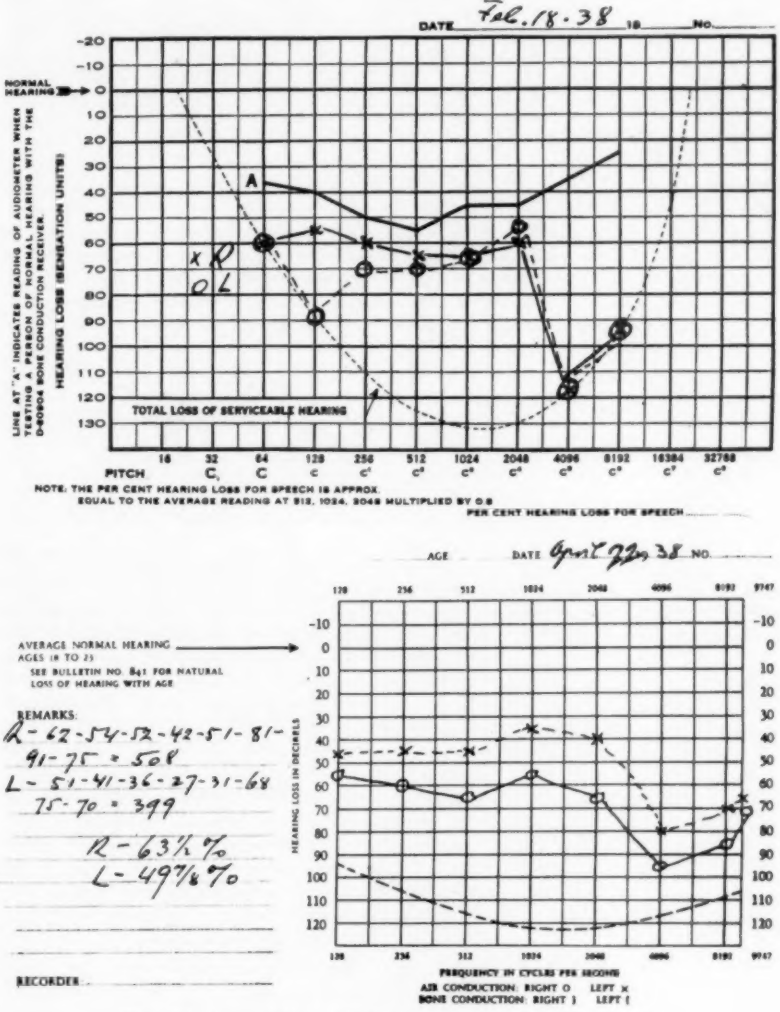

Fig. 35 (case 12).—Audiograms of woman aged 32.

On Jan. 7, 1937, right radical mastoidectomy was performed, the malleus and the incus being removed but the entire drum being preserved. After completion of the operation the drum was separated from the annulus tympanicus, except at its attachment to the upper half of the anterior aspect, and was then applied and made to adhere to the mesial tympanic wall. The object of the procedure was twofold: (1) to shut off the eustachian tube and (2) to obtain an outgrowth

of thin epidermis for subsequent use as a flap for the sealing of the fistula in the external semicircular canal.

After this radical operation the hearing by audiometric tests showed an improvement, but there was no improvement in practical hearing.

A postoperative hearing test (air conduction) on Jan. 13, 1937, showed a 63 per cent loss in the right ear and a 79⅛ per cent loss in the left ear.

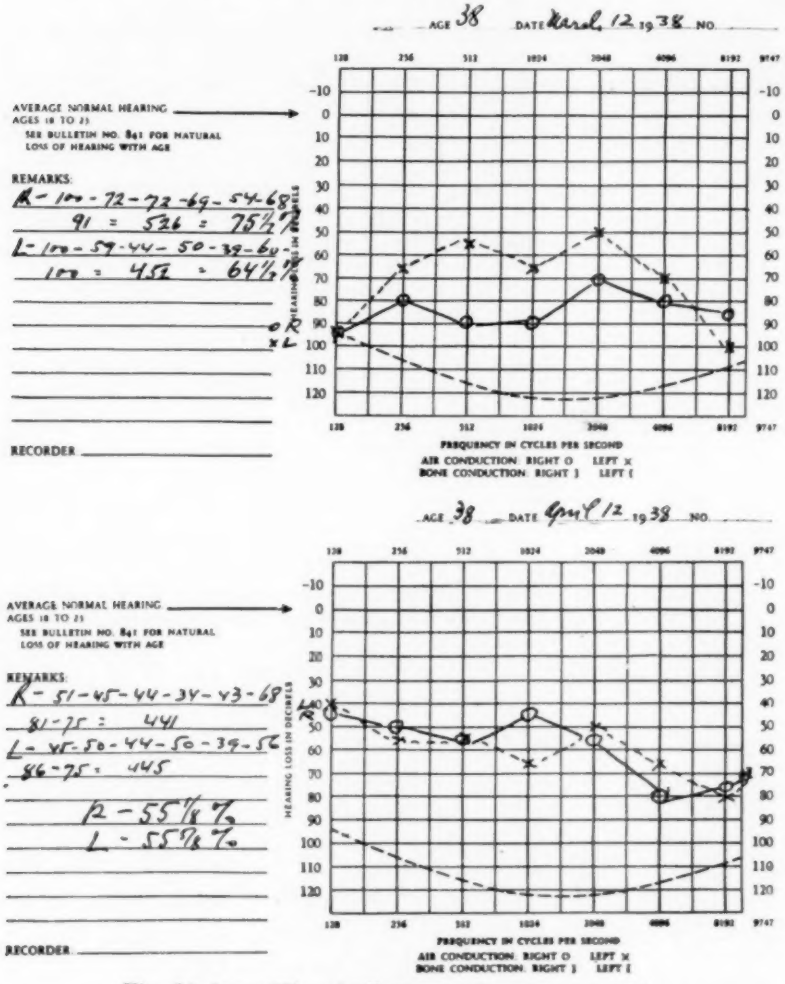
AGE 38 DATE March 12 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 100 - 72 - 72 - 69 - 54 - 68
91 ÷ 526 = 75½%
L - 100 - 59 - 44 - 50 - 39 - 64
100 ÷ 452 = 64½%
RECORDER
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [
AGE 38 DATE April 12 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 51 - 45 - 44 - 34 - 43 - 68
81 - 75 = 441
L - 45 - 50 - 44 - 50 - 39 - 56
86 - 75 = 445
R - 55⅛%
L - 55⅛%
RECORDER
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [

Fig. 36 (case 13).—Audiograms of woman aged 38.

On March 19, 1937, the epidermal outgrowth was dissected from the bone, and the external semicircular canal was opened. The flap was found to be too thin and not sufficiently long to cover the entire fenestra in the canal. The immediate hearing was excellent (14 feet [427 cm.] for ordinary spoken voice). This dropped on the third day to the level noted prior to operation.

On Jan. 11, 1938, the Lempert operation was performed on the left ear. Immediate improvement was noted.

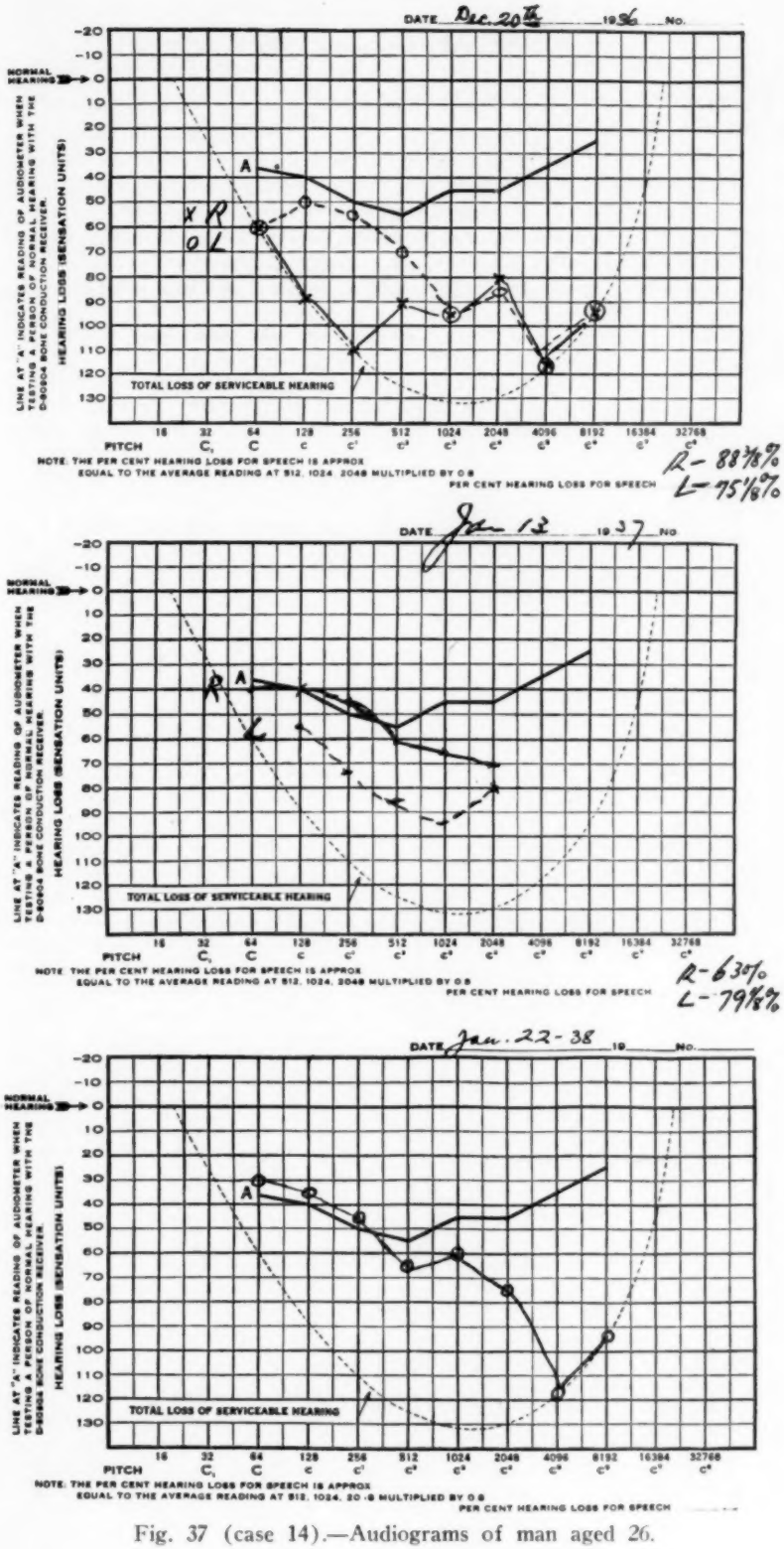
DATE Dec. 20th 1936 No.
NORMAL HEARING
-20
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
LINE AT "A" INDICATES READING OF AUDIOMETER WHEN TESTING A PERSON OF NORMAL HEARING WITH THE D-90804 BONE CONDUCTION RECEIVER.
HEARING LOSS (SENSATION UNITS)
A
R
L
TOTAL LOSS OF SERVICEABLE HEARING
16 32 64 128 256 512 1024 2048 4096 8192 16384 32768
PITCH C1 C c c1 c2 c3 c4 c5 c6 c7
NOTE: THE PER CENT HEARING LOSS FOR SPEECH IS APPROX EQUAL TO THE AVERAGE READING AT 512, 1024, 2048 MULTIPLIED BY 0.8
PER CENT HEARING LOSS FOR SPEECH
R- 88⅛%
L- 75⅛%
DATE Jan 13 1937 No
NORMAL HEARING
LINE AT "A" INDICATES READING OF AUDIOMETER WHEN TESTING A PERSON OF NORMAL HEARING WITH THE D-90804 BONE CONDUCTION RECEIVER.
HEARING LOSS (SENSATION UNITS)
R
A
L
TOTAL LOSS OF SERVICEABLE HEARING
16 32 64 128 256 512 1024 2048 4096 8192 16384 32768
PITCH C1 C c c1 c2 c3 c4 c5 c6 c7
NOTE: THE PER CENT HEARING LOSS FOR SPEECH IS APPROX EQUAL TO THE AVERAGE READING AT 512, 1024, 2048 MULTIPLIED BY 0.8
PER CENT HEARING LOSS FOR SPEECH
R- 63%
L- 79⅛%
DATE Jan. 22-38 19 No.
NORMAL HEARING
LINE AT "A" INDICATES READING OF AUDIOMETER WHEN TESTING A PERSON OF NORMAL HEARING WITH THE D-90804 BONE CONDUCTION RECEIVER.
HEARING LOSS (SENSATION UNITS)
A
TOTAL LOSS OF SERVICEABLE HEARING
16 32 64 128 256 512 1024 2048 4096 8192 16384 32768
PITCH C1 C c c1 c2 c3 c4 c5 c6 c7
NOTE: THE PER CENT HEARING LOSS FOR SPEECH IS APPROX EQUAL TO THE AVERAGE READING AT 512, 1024, 2048 MULTIPLIED BY 0.8
PER CENT HEARING LOSS FOR SPEECH

Fig. 37 (case 14).—Audiograms of man aged 26.

A postoperative hearing test (air conduction) on Jan. 22, 1938, showed a 60 per cent loss in the left ear.

Comment: This patient, who did not hear for practical purposes even with a hearing apparatus, was able, after operation, to hear better than he had before without a bone conduction aid. Despite this fact and the impressive audiometric improvement, the loss in hearing preoperatively was too great to warrant operation with expectation of practical improvement in hearing. On May 14, 1938, a fistula test gave strongly positive results. No practical improvement was noted in hearing.

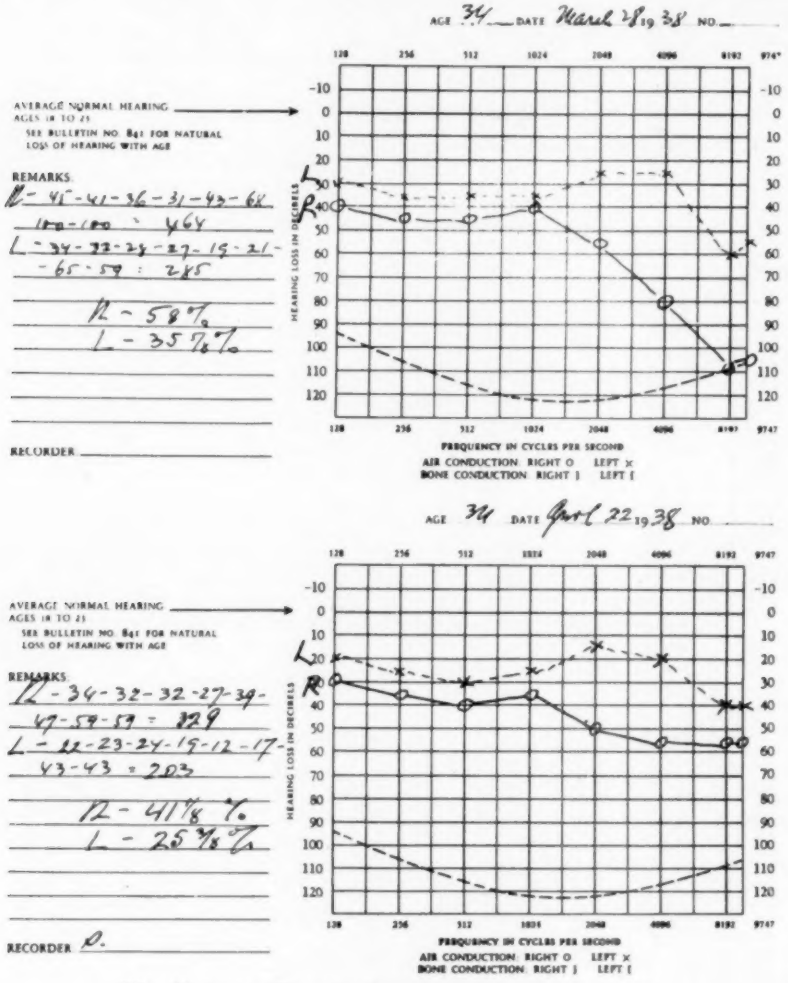
AGE 34 DATE March 28 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS
R - 41-41-36-31-43-64
128-1000 : 464
L - 34-33-25-37-15-21-65-59 : 285
R - 58%
L - 35 7/8%
RECORDER
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION RIGHT O LEFT X
BONE CONDUCTION RIGHT] LEFT [
AGE 34 DATE April 22 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS
R - 34-32-32-27-39-47-59-59 = 329
L - 22-23-24-19-12-17-43-43 = 203
R - 41 1/8 %
L - 25 3/8 %
RECORDER O.
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION RIGHT O LEFT X
BONE CONDUCTION RIGHT] LEFT [

Fig. 38 (case 15).—Audiograms of woman aged 29.

CASE 15.—A woman aged 29, a stenographer, had been hard of hearing for twelve years, the defect being worse in the right ear. She complained of severe tinnitus in both ears. The condition became progressively worse. Tonsillectomy had been performed five years before examination and a nasal operation a year later. There had been no otitic suppuration, and both drums were normal. The father was deafened.

Preoperative hearing test on March 28, 1938, showed, by air conduction, a 58 per cent loss in the right ear and a 35 per cent loss in the left ear; by bone conduction hearing was within normal indicated limits.

On March 29, 1938, the Lempert operation was performed on the right ear.

A postoperative hearing test (air conduction) on April 22, 1938, showed a 41⅛ per cent loss in the right ear and a 25⅜ per cent loss in the left ear.

Comment: The fistula was maintained. The tinnitus completely disappeared. There was marked improvement in practical hearing, the patient being able to

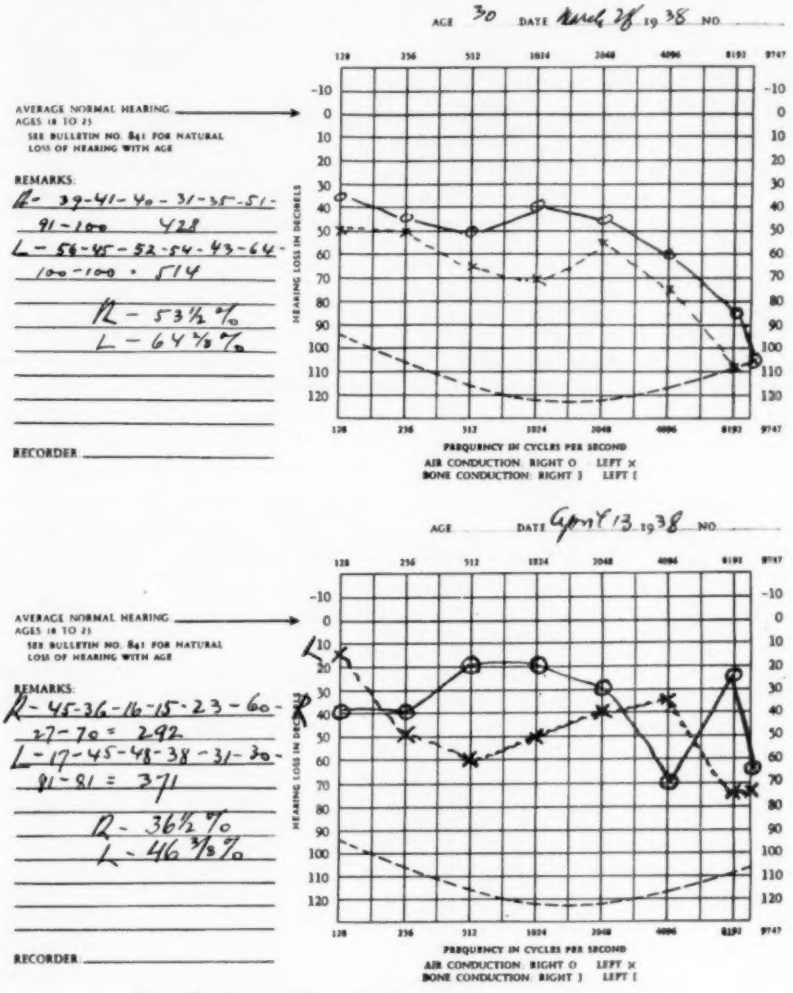
AGE 30 DATE March 28 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R- 39-41-40-31-35-51-
91-100 428
L- 56-45-52-54-43-64-
100-100 514
R- 53½ %
L- 64⅛ %
RECORDER
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [
AGE DATE April 13 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R- 45-36-16-15-23-60-
27-70 = 292
L- 17-45-48-38-31-30-
81-81 = 371
R- 36½ %
L- 46⅜ %
RECORDER
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [

Fig. 39 (case 16).—Audiograms of man aged 32.

hear whispers. On May 14, 1938, a fistula test gave strongly positive results; improvement in hearing had been maintained.

CASE 16.—A man aged 32, a roofer, had been hard of hearing for twenty years; during the last six years of the period the condition had become progressively worse; it was more marked in the left ear. There had been deafness

in the family. Thyroxin was injected into the ear without any result. A nasal operation had been performed four years before examination. There was no otitic infection.

Preoperative hearing tests on March 28, 1938, showed, by air conduction, a 53½ per cent loss in the right ear and a 64¼ per cent loss in the left ear; by bone conduction hearing was within normal indicated limits.

On March 30, 1938, the Lempert operation was performed on the right ear.

A postoperative hearing test (air conduction) on April 13, 1938, showed a 36½ per cent loss in the right ear and a 46⅜ per cent loss in the left ear.

Comment: Practical hearing was restored and maintained in this case. On May 14, 1938, a fistula test gave strongly positive results. The improvement in hearing had been maintained.

CASE 17.—A man aged 30, a sales promoter, had a father and a paternal aunt who were hard of hearing. When still a boy, the patient accidentally discovered that when he applied the telephone receiver to the left ear he could not hear. This condition became progressively worse until five years before examination, when the loss in practical hearing became evident in both ears. Tinnitus in both ears was brought on by changes in the weather. The patient could not hear the spoken voice without a bone conduction aid. There was no otitic inflammation. Tonsillectomy and adenoidectomy had been performed twelve years before.

Preoperative hearing tests on March 26, 1938, showed, by air conduction, a 62¼ per cent loss in the right ear and a 79 per cent loss in the left ear; by bone conduction hearing was within normal indicated limits.

On March 31, 1938, the Lempert operation was performed on the right ear.

A postoperative hearing test (air conduction) on April 20, 1938, showed a 48¾ per cent loss in the right ear and a 79 per cent loss in the left ear.

Comment: The patient discarded his hearing aid, and for practical purposes his hearing was much improved. On May 14, 1938, a fistula test gave strongly positive results. The gain in hearing had been maintained.

CASE 18.—A woman aged 27, a housewife, had been hard of hearing for about six years, but in the two years before examination the condition had become worse. She stated that a cold and an abscess in the right ear had preceded the onset of the deafness. Tonsillectomy had been performed. The patient had tinnitus. A paternal aunt was hard of hearing. Since childbirth, one year before, hearing had become much worse. The patient wore a hearing aid.

A preoperative hearing test (air conduction) on March 17, 1938, showed a 79⅝ per cent loss in the right ear and a 72⅝ per cent loss in the left ear.

On April 2, 1938, the Lempert operation was performed on the right ear.

A postoperative hearing test (air conduction) on April 27, 1938, showed a 78 per cent loss in the right ear and an 81½ per cent loss in the left ear.

Comment: There was no response in hearing at the time of operation, and there was no improvement thereafter. The patient had poor bone conduction within the conversational voice range before operation and was told that she was not a suitable subject for operation, but she insisted on being given the trial. On May 14, 1938, a fistula test gave strongly positive results. There was no improvement in hearing.

CASE 19.—A man aged 29, a landscape inspector, had had an attack of pleurisy eighteen years before examination. He was known to have a chronic but well compensated valvular disease. He first became hard of hearing in October 1937 and had had throbbing and whistling noises in his left ear since then. There was no deafness in the family.

A preoperative hearing test (air conduction) on March 14, 1938, showed a 59⅛ per cent loss in both ears.

On March 25, 1938, the Lempert operation was performed on the right ear.

A postoperative hearing test (air conduction) on April 25, 1938, showed a 37¼ per cent loss in the right ear and a 55¾ per cent loss in the left ear.

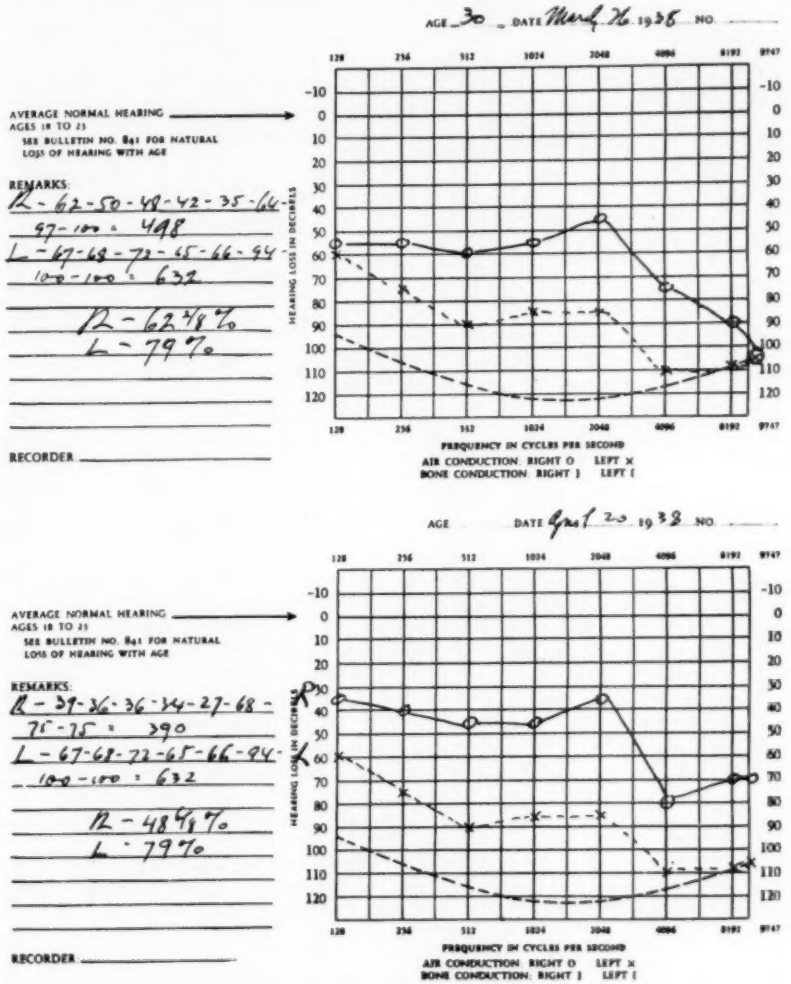
AGE 30 DATE March 26 1938 NO.
AVERAGE NORMAL HEARING
AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 62-50-48-42-35-64-
97-100 = 498
L - 67-68-72-65-66-94
100-100 = 632
R - 62 2/8 %
L - 79 %
RECORDER
HEARING LOSS IN DECIBELS
128 256 512 1024 2048 4096 8192 16384
-10 0 10 20 30 40 50 60 70 80 90 100 110 120
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION RIGHT O LEFT X
BONE CONDUCTION RIGHT] LEFT [
AGE DATE April 20 1938 NO.
AVERAGE NORMAL HEARING
AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 39-36-36-34-27-68-
75-75 = 390
L - 67-68-72-65-66-94
100-100 = 632
R - 48 4/8 %
L - 79 %
RECORDER
HEARING LOSS IN DECIBELS
128 256 512 1024 2048 4096 8192 16384
-10 0 10 20 30 40 50 60 70 80 90 100 110 120
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION RIGHT O LEFT X
BONE CONDUCTION RIGHT] LEFT [

Fig. 40 (case 17).—Audiograms of man aged 30.

Comment: This patient, who had passed a civil service examination, was rejected because of his poor hearing. He was given a three months' probationary period during which he could seek treatment. The operation was performed, and his practical hearing so markedly improved that he passed the physical examination of the Civil Service Commission.

A study of the charts of preoperative and postoperative hearing in this case shows the improvement in postoperative hearing for the frequencies of 128, 256,

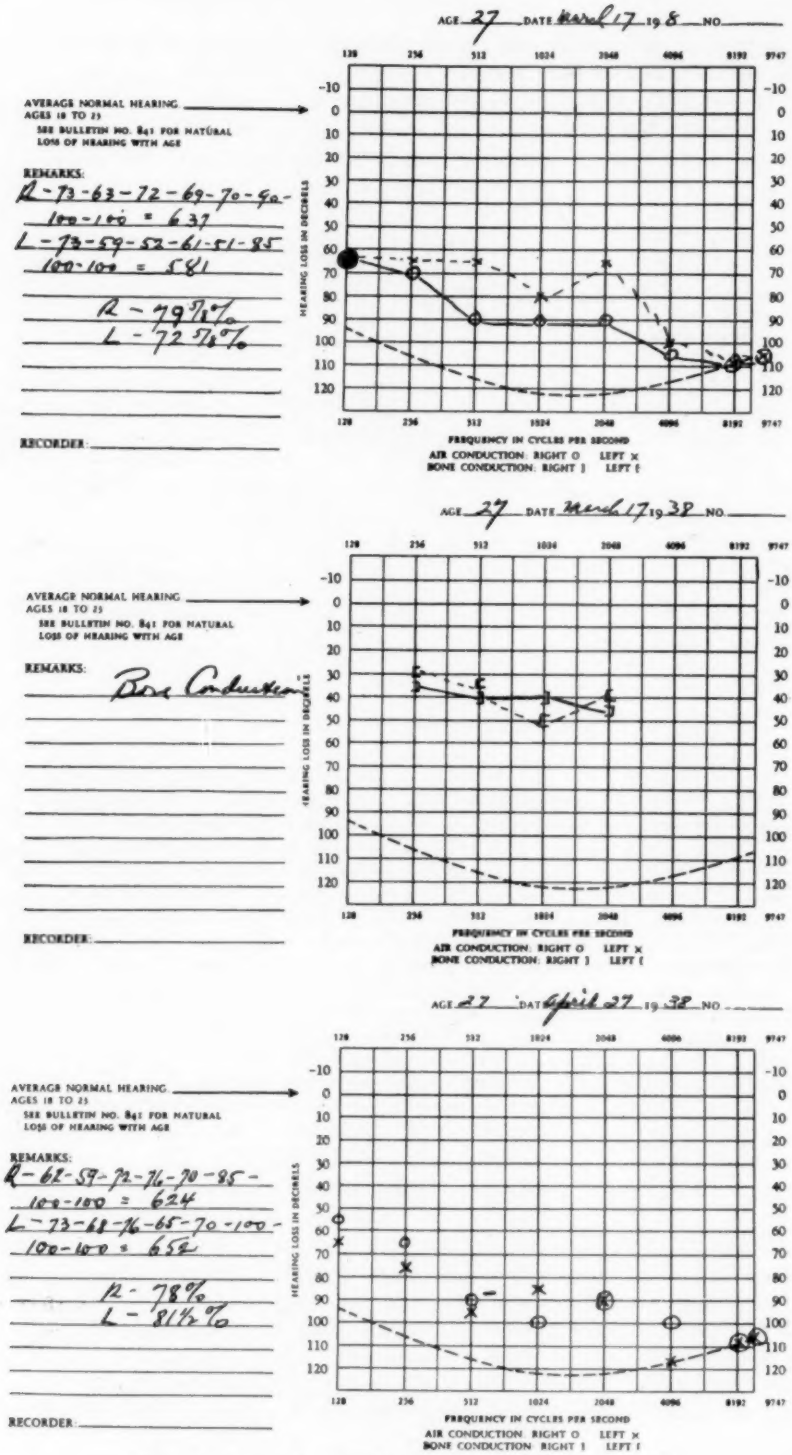
AGE 27 DATE March 17 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 73 - 63 - 72 - 69 - 70 - 90 -
100 - 100 = 637
L - 73 - 59 - 52 - 61 - 51 - 85
100 - 100 = 581
R - 79 7/8%
L - 72 7/8%
RECORDER:
HEARING LOSS IN DECIBELS
128 256 512 1024 2048 4096 8192 9747
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [
AGE 27 DATE March 17 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS: Bone Conduction
RECORDER:
HEARING LOSS IN DECIBELS
128 256 512 1024 2048 4096 8192 9747
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [
AGE 27 DATE April 27 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 62 - 59 - 72 - 76 - 70 - 85 -
100 - 100 = 624
L - 73 - 68 - 76 - 65 - 70 - 100 -
100 - 100 = 652
R - 78%
L - 81 1/2%
RECORDER:
HEARING LOSS IN DECIBELS
128 256 512 1024 2048 4096 8192 9747
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [

Fig. 41 (case 18).—Audiograms of woman aged 27.

512 and 1024 double vibrations. The drop in perception of the high notes, however, accounts for the reduction in the average estimation of hearing by percentage. On May 14, 1938, a fistula test gave strongly positive results. The gain in hearing had been maintained.

CASE 20.—A woman aged 42, a housewife, first became hard of hearing about ten years before examination. The defect gradually became worse and was

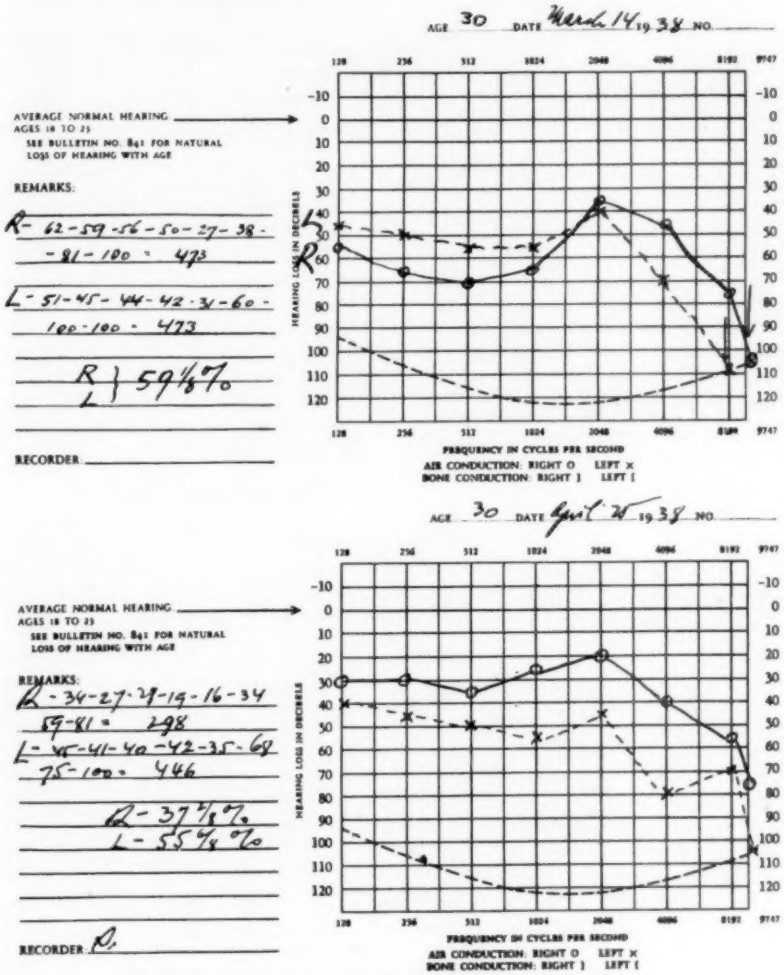
AGE 30 DATE March 14 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R- 62-59-56-50-27-38-
-81-100 = 473
L- 51-45-44-42-34-60-
100-100 = 473
R 59⅛%
L
RECORDER
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [
AGE 30 DATE April 1 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 34-27-29-19-16-34
59-81 = 298
L- 45-41-40-42-35-69
75-100 = 446
R- 37⅞%
L- 55⅝%
RECORDER D.
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [

Fig. 42 (case 19).—Audiograms of man aged 29.

accompanied with severe tinnitus. Tonsillectomy was performed ten years before, to obtain improvement in hearing. There has been no deafness in the family.

Preoperative hearing tests on April 1, 1938, showed, by air conduction, a 42¼ per cent loss in the right ear and a 50⅛ per cent loss in the left ear; by bone conduction hearing was within normal indicated limits.

On April 6, 1938, the Lempert operation was performed on the right ear.

A postoperative hearing test (air conduction) on April 25, 1938, showed a 27 per cent loss in the right ear and a 46¼ per cent loss in the left ear.

Comment: The improvement in hearing was marked immediately after operation and has continued since then. On May 14, 1938, a fistula test gave strongly positive results. The gain in hearing had been maintained.

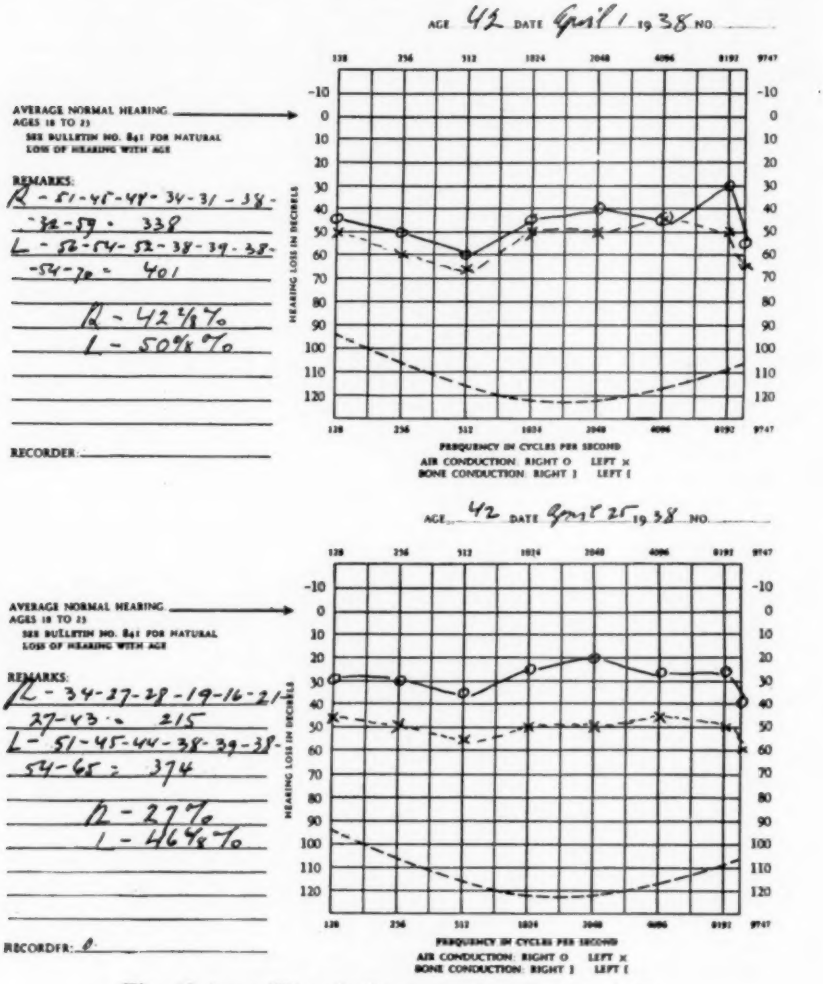
AGE 42 DATE April 1 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 51-45-44-34-31-38-32-39 = 338
L - 52-54-52-38-39-38-54-70 = 401
R - 42⅛%
L - 50⅛%
RECORDER:
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION RIGHT O LEFT X
BONE CONDUCTION RIGHT] LEFT [
AGE 42 DATE April 25 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 34-37-28-19-16-21-27-43 = 215
L - 51-45-44-38-39-38-54-65 = 374
R - 27%
L - 46⅛%
RECORDER:
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION RIGHT O LEFT X
BONE CONDUCTION RIGHT] LEFT [

Fig. 43 (case 20).—Audiograms of woman aged 42.

CASE 21.—A woman aged 29, a housewife, had first noticed hardness of hearing six years before examination, after childbirth. Her mother had experienced a similar onset of deafness. There was intermittent tinnitus. The patient had had tonsillitis in childhood and pneumonia at the age of 12 years. In the last year she had had vertigo in the mornings.

Preoperative hearing tests on April 5, 1938, showed, by air conduction, a 52⅛ per cent loss in the right ear and a 59 per cent loss in the left ear; by bone conduction hearing was slightly below the normal limits.

On April 7, 1938, the Lempert operation was performed on the right ear. A postoperative hearing test (air conduction) on April 25, 1938, showed a 33⅞ per cent loss in the right ear and a 54⅜ per cent loss in the left ear.

Comment: The fistula was open, and there was good functional hearing. On May 14, 1938, a fistula test gave strongly positive results; the improvement in hearing had been maintained.

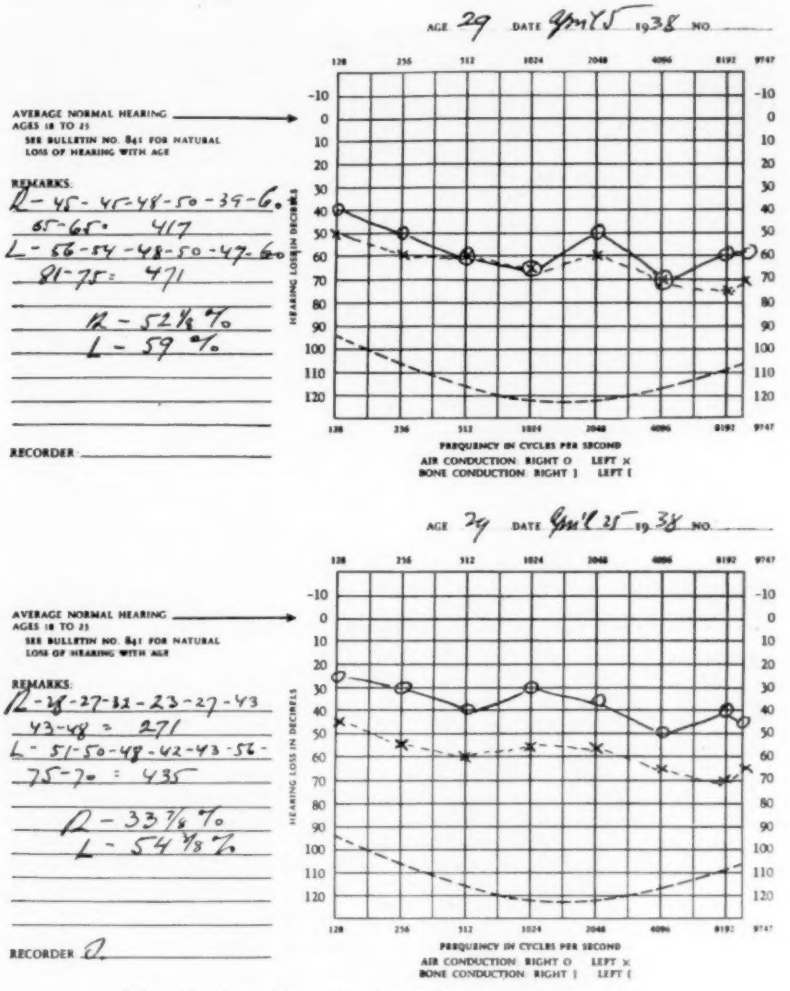
AGE 29 DATE Apr 25 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 45-45-48-50-39-6.
65-65. 417
L - 56-54-48-50-47-60
81-75 = 471
R - 52⅛ %
L - 59 %
RECORDER
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION RIGHT O LEFT X
BONE CONDUCTION RIGHT] LEFT [
AGE 24 DATE Apr 25 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 28-27-32-23-27-43
43-48 = 271
L - 51-50-48-42-43-56-
75-70 = 435
R - 33⅞ %
L - 54⅜ %
RECORDER O.
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION RIGHT O LEFT X
BONE CONDUCTION RIGHT] LEFT [

Fig. 44 (case 21).—Audiograms of woman aged 29.

CASE 22.—A man aged 24, a salesman, had been hard of hearing since birth, the right ear being worse than the left. He had had an abscess in the left ear at the age of 1 year. Hearing had become progressively worse in the last two years. Tinnitus was marked in both ears. His father and mother were both hard of hearing.

Preoperative hearing tests on March 19, 1938, showed, by air conduction, a 58¼ per cent loss in the right ear and a 51¾ per cent loss in the left ear; by bone conduction hearing was below the normal indicated limits, that of only two pitches (512 and 1024 double vibrations) within the conversational range being within normal limits (determined by masking).

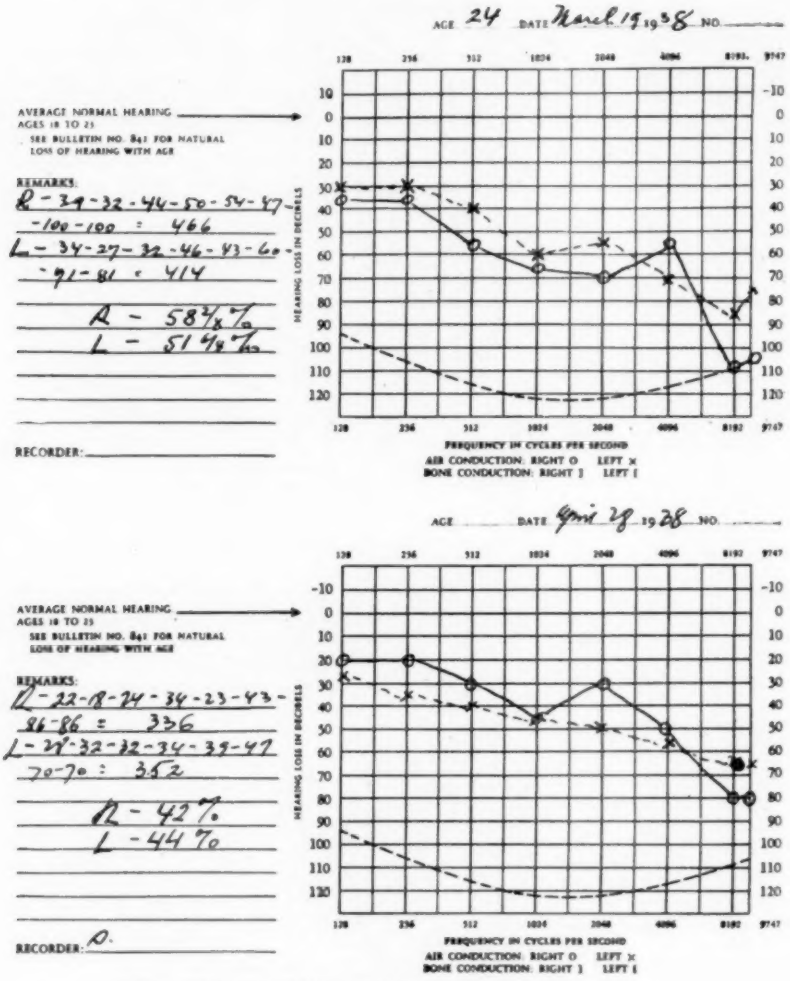
AGE 24 DATE March 19 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 39-32-44-50-54-47
-100-100 = 466
L - 34-27-32-46-43-60
-91-81 = 414
R - 58¾%
L - 51¾%
RECORDER:
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [
AGE DATE April 28 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 22-18-24-34-23-43
86-86 = 336
L - 24-32-32-34-39-47
70-70 = 352
R - 42%
L - 44%
RECORDER: D.
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [

Fig. 45 (case 22).—Audiograms of man aged 24.

On April 14, 1938, the Lempert operation was performed on the right ear.

A postoperative hearing test (air conduction) on April 28, 1938, showed a 42 per cent loss in the right ear and a 44 per cent loss in the left ear.

Comment: Improvement in hearing at the time of operation was marked; the fistula was open. On May 14, 1938, a fistula test gave strongly positive results. The gain in hearing had been maintained.

CASE 23.—A man aged 37, a lawyer, had been hard of hearing for twelve years. He stated that the onset of deafness had followed diving and complained of tinnitus in both ears. He wore a hearing aid over the left ear. His mother and a maternal aunt and uncle were hard of hearing.

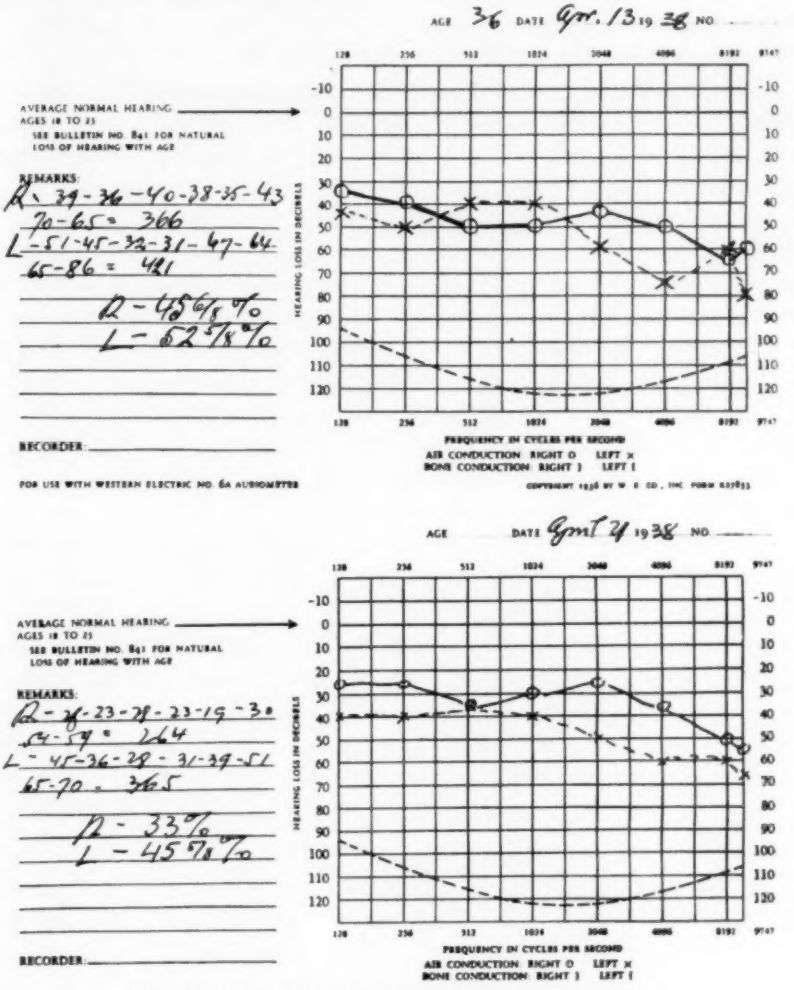
AGE 36 DATE Apr. 13 19 38 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 39-36-40-38-35-43
70-65 = 366
L - 51-45-33-31-47-64
65-86 = 481
R - 45 6/8 %
L - 52 5/8 %
RECORDER:
FOR USE WITH WESTERN ELECTRIC NO. 6A AUDIOMETER
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION RIGHT O LEFT X
BONE CONDUCTION RIGHT) LEFT (
AGE DATE Apr 21 1938 NO.
AVERAGE NORMAL HEARING AGES 18 TO 25
SEE BULLETIN NO. 841 FOR NATURAL LOSS OF HEARING WITH AGE
REMARKS:
R - 26-23-28-23-19-30
54-59 = 264
L - 45-36-28-31-39-51
65-70 = 365
R - 33%
L - 45 7/8 %
RECORDER:
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION RIGHT O LEFT X
BONE CONDUCTION RIGHT) LEFT (

Fig. 46 (case 23).—Audiograms of man aged 37.

Preoperative hearing tests on April 13, 1938, showed, by air conduction, a loss of 45⅜ per cent in the right ear and of 52⅝ per cent in the left ear; by bone conduction hearing was within normal indicated limits.

On April 14, 1938, the Lempert operation was performed on the right ear.

Postoperative hearing tests (air conduction) on April 21, 1938, showed a 33 per cent loss in the right ear and a 45⅝ per cent loss in the left ear.

Comment: The patient discarded his hearing aid and was able to hear normal conversation. On May 14, 1938, a fistula test gave strongly positive results. The improvement in hearing had been maintained.

CONCLUSIONS

A new technic for the improvement of hearing of patients with otosclerosis is offered. It is a delicate, highly technical surgical procedure designed to create a fenestra in the bony capsule of the external semicircular canal and to provide a mechanical means of keeping this newly created fenestra permanently open. To obtain the desired results it is essential that every step in this technic be patiently and skilfully executed in its minutest detail. To bring this operative procedure to a successful conclusion it is absolutely essential that every surgical step be performed in the exact order described. Each step in this technic is the foundation for the next step, and unless each step is concluded successfully, the next step and therefore the rest of the operation are doomed to failure. This surgical technic should not be attempted by any young otologist unless he is especially trained for surgical measures of this type. Any otologist with a keen knowledge and understanding of the minutest details in the anatomy of the temporal bone, resulting from a large and varied personal experience in operations on it, will master this technic without any difficulty after seeing it carried out.

The endaural, antauricular approach to the temporal bone is employed for the following reasons:

1. The tympanomeatal cutaneous membrane which I have described can be obtained only when the endaural, antauricular approach to the temporal bone is employed.

2. To avoid the risk of postoperative infection, in addition to applying the strictest rules of asepsis, it is necessary to limit the surgical attack to the tissues directly concerned and thus reach the objective with the least amount of sacrifice of tissue. This is best accomplished by employing the endaural, antauricular approach.

3. Better visibility and accessibility of the desired surgical field are obtained by this approach.

4. The employment of the endaural, antauricular approach is followed by a convalescence involving the least possible social and economic inconvenience to the patient.

5. Cosmetically, the endaural, antauricular approach results in a status as near as possible to that preceding the operation.

I have operated on 23 patients with otosclerosis by the described technic. In 19 cases a good practical improvement in hearing was obtained and maintained. In 4 cases in which operation was performed in spite of poor existing bone conduction, no improvement in hearing was obtained.

This surgical technic was carried out and all the postoperative dressings made under the strictest rules of asepsis. In no case was there a

postoperative infection of the tympanic cavity, the mastoid cavity or the labyrinth.

Of the 23 patients operated on, the newly created fistula in the external semicircular canal remained open in 22. In 1 case the fistula began to show signs of closure at the end of ten days and was completely closed at the end of three weeks. I believe that in the 22 patients in whom the fistula remained open it will remain permanently open. My previous experience has shown that when regeneration of bone takes place in a newly created fistula, it does so immediately, and clinical evidence substantiating this fact may be observed after the first deep dressing. At the time of each dressing the response to the fistula test becomes less marked, until about four weeks postoperatively, when the fistula test gives a completely negative result. When regeneration of bone does not take place, the response to the fistula test continues to remain strongly positive, showing no signs of decreasing intensity.

I believe that it is reasonable to assume that a fistula which has not shown signs of beginning regeneration of bone after two months will remain permanently open.

NASAL ALLERGY

ALBERT H. ROWE, M.D.
SAN FRANCISCO

"Nasal allergy," as a term, will probably replace many of the former terms, such as "hay fever," "vasomotor rhinitis," "hyperesthetic rhinitis," "paroxysmal rhinorrhea," "nasal neurosis," "nasal hydrorrhea," "catarrhal rhinitis," "spasmodic coryza" and "perennial hay fever." Various ingestant and inhalant allergens and in a few cases bacterial allergens are proving to be the causes of the syndrome which has inspired this terminology in the past. During the last twenty years, however, an increasing number of patients with these nasal symptoms have responded to thorough study and adequate treatment utilizing the ever widening knowledge of allergy and its causes. At present a comparatively small group of these sufferers remains whose symptoms resist allergic therapy. For a condition presenting such symptoms, the term "vasomotor rhinitis" may be appropriate, but no condition should be thus classified without thorough allergic diagnosis and treatment, and the classification, even then, does not remove the challenge to a continued search for possible sensitizations which have eluded discovery by the allergist.

NASAL ALLERGY

Etiology.—Seasonal Nasal Allergy [1]: It is now recognized that this condition is usually due to pollens, though spores of fungi, seasonal and occupational dusts, and other inhalants, independently or together with pollen, may also cause symptoms, as may certain foods.

Perennial Nasal Allergy: This form, causing constant or intermittent symptoms, is usually due to inhalants, such as animal emanations, orris, pyrethrum, occupational or house dusts and fungi. It is also frequently due to food. Pollens which are in the air of certain areas, such as San Francisco, throughout the year, or in house dust, having settled there during the pollen season, at times cause perennial symptoms, with exaggeration during the periods of pollination. Inhalant allergy results in sneezing, in watery or mucoid discharge and especially in itching of the nose, the eyes and often the throat and ears. Headaches, nasal occlusion, aching in the region of the antrums, difficulty

Read before the San Francisco County Medical Society, August 1937.

1. Rowe, A. H.: Clinical Allergy: Manifestations, Diagnosis and Treatment, Philadelphia, Lea & Febiger, 1937.

with hearing and pharyngeal congestion, productive of hacking and clearing the throat, often arise. In food allergy [1] the occlusion may be worse and loss of the sense of smell more frequent. Sneezing may vary in degree, and itching is usually absent when the condition is due to food allergy.

Nasal Allergy in Children: [2] This is very common. It produces congestion, nasal blocking, sneezing, itching, mouth breathing, clearing of the throat, hacking, snorting, noisy breathing, pushing, picking and rubbing the nose and restless sleep. Itching is usually absent in cases of food allergy. Bacterial allergy as a primary cause of such symptoms rarely occurs, and the infrequency of complicating sinusitis in children is striking. Differentiation of nasal allergy and nasal infection,[3] which produces a red rather than a pale, boggy mucosa and polymorphonuclear white cells rather than eosinophils in the nasal secretions, is most important. The frequency with which in children attacks of nasal allergy and especially of asthma are initiated by sneezing, coryza and allergic nasal congestion, which suggest an infectious cold, has led to the erroneous idea that infections cause such attacks.

Clinical Picture.—Nasal allergy produces a pale, edematous mucosa of varying redness. Redness increases when active infection is present. Occlusion may be severe, since the tissue is of a loose, erectile type. With continued swelling, the mucous membrane thickens, and polypoid degeneration may result, owing to outpouching of the membrane caused by closure of the glandular orifices. Such chronic allergy is one of the common causes of hyperplastic rhinitis, even in the ethmoid sinuses, according to Hansel.[3] Allergic edema is usually greatest on the lower edge of the middle turbinated bone, in the middle meatus, at times on the anterior edge of the inferior turbinated bone, and over the tubercle of the septum. These areas lie in the so-called respiratory zone of the nose. In the quiescent periods the membrane may resume its normal appearance. Microscopically, eosinophilic infiltration of the tunica propria and other layers of the mucosa, hyalinization and thickening of the basement membrane, round cell infiltration of the connective tissue and dilatation and compression of blood vessels are observed. Similar changes, especially thickening of the membrane and cystic or polypoid degeneration, may exist in the sinuses together with those in the nasal sinuses or independently.

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2. Rowe, A. H.: Nasal and Bronchial Allergy in Childhood, Arch. Otolaryng. **21**:653 (June) 1935.

3. Hansel, F. K.: Allergy of the Nose and Paranasal Sinuses: A Monograph on the Subject of Allergy as Related to Otolaryngology, St. Louis, C. V. Mosby Company, 1936.

It is important to realize that both infection and allergy may produce acute or chronic rhinitis, sinusitis, pharyngitis, tracheitis, bronchitis or laryngitis. The absence of fever and malaise, the presence of a red rather than a pale, boggy nasal mucosa, the history of the symptoms and, particularly, the presence of eosinophils with comparatively few polymorphonuclear cells in the nasal mucus favor a diagnosis of allergy. In the differential diagnosis the value of cytologic examination of the nasal secretions must be stressed, and will be discussed later. The mistake must not be made of treating nasal symptoms arising from infected sinuses, especially the antrums, and from apical abscesses of the teeth with allergic measures.

Diagnosis.—The diagnosis of seasonal (acute) and perennial (chronic) nasal allergy depends on several factors. The history, particularly of sneezing, nasal blocking and watery or mucoid discharge, with or without itching, especially in the mornings, always should suggest allergy. The presence of other allergic disturbances in the patient or in his progenitors is important. The pale, edematous membrane, with or without polyps, indicates the presence of allergy. Positive cutaneous reactions offer helpful evidence, though in the presence of active allergy, especially to foods, negative reactions frequently occur. In these cases intranasal or conjunctival inhalations of specific allergens may result in sneezing, itching and watery discharge, indicative of mucosal allergy. Dean, Linton and Linton [4] obtained positive results from scratch and intramucosal tests on the mucous membranes with the allergens wheat, milk and eggs when the cutaneous reactions were negative. Roentgenograms of the sinuses may reveal thickened membranes, polypoid degeneration or varying opacity. The study of such mucosal swellings can be made with instillations of iodized poppyseed oil. This seems necessary only in selected cases and is contraindicated if iodine allergy is demonstrated by the ingestion of potassium iodide for a day or two. The transient edema in the antral mucosa from the temporary effect of an allergen must be remembered. It is also recognized that these roentgenologic findings may arise from either infection or allergy and that they may indicate past difficulty which has been controlled. Without the results of allergic therapy based on careful and thorough allergic investigations having been ascertained, such roentgenologic findings should never form the sole basis for surgical intervention. In fact, the diagnosis of allergy usually cannot be certain until the results of therapy conducted for at least several weeks are determined. In other words, the final diagnosis usually must depend

4. Dean, L. W.; Linton, L. D., and Linton, C. S.: An Intramucosal Test for Hypersensitivity in Allergic Rhinitis, Ann. Otol., Rhin. & Laryng. **44**:317, 1935.

on the therapeutic test. Finally, the cytologic study of the nasal secretions [5] offers important evidence in determining whether the condition is allergy or infection. Smears of nasal secretions are stained with Wright's stain or preferably with Giemsa's stain. The patient may blow into a piece of cellophane and later the clumps of mucus may be smeared on slides, or the mucus may be obtained on a tightly wound cotton applicator. Watery secretion is not especially suitable. Clumps of eosinophils indicate the presence of allergy, and the absence of these cells in smears on several days is necessary to rule out a diagnosis of allergy. The relative number of eosinophil or of polymorphonuclear cells indicates the relative amount of allergy or of infection present. If allergy is indicated, careful studies must be conducted in order to find the specific allergenic causes. Eosinophils in the nasal secretions come from the infiltration of the nasal mucosa with these cells. Their presence in the sputum of persons with asthma and in the secretions from the eyes, intestine and vagina when these tissues are the seat of allergic disturbances is common knowledge. Eosinophils in the nasal secretions probably indicate inhalant or ingestant allergy. Cooke [6] also reported finding them in cases of bacterial allergy.

Treatment.—The treatment of nasal allergy needs special discussion. When inhalant allergens cause acute or chronic symptoms, hyposensitization with antigens containing all the specific important allergens, whether they are pollens, animal emanations, orris, pyrethrum, cottonseed, kapok, fungi, dusts, silk or any of a number of others, is necessary. Care not to exaggerate the symptoms by giving too large or too frequent doses and sufficiently prolonged therapy, often over a period of from one to three years, are usually necessary. At times elimination of the inhalants makes hyposensitization unnecessary. Environmental control and, when pollen allergy is present, the use of an air filter are frequently important. The frequency of kapok and cottonseed allergy, particularly from old mattresses and upholstery, has been recognized, especially by Rackemann. Thus, dustproof covers on mattresses and pillows are often desirable. When food allergy is suspected, elimination diets [1] which exclude foods commonly productive of allergy are usually valuable, not only for diagnosis but also for treatment. Cutaneous tests infrequently show all the foods to which allergy exists,[7] and positive reactions to tests with nonallergenic foods, especially the

5. Hansel, F. K.: Observations on Cytology of Secretions in Allergy of Nose and Paranasal Sinuses, J. Allergy **5**:357, 1934.

6. Cooke, R. A.: Infective Asthma: Indication of Its Allergic Nature, Am. J. M. Sc. **183**:309, 1932.

7. Rowe, A. H.: The Evaluation of Skin Reactions in Food Sensitive Patients, J. Allergy **5**:135, 1934.

intradermal test, are not uncommon. With control of symptoms, a gradual enlargement of the diet is made according to the symptomatic response to foods which are included. Exclusion of drugs, such as acetylsalicylic acid, which occasionally produce nasal allergy is necessary when the patient is allergic to them. The combination of food and inhalant sensitizations, especially in cases of perennial allergy, must be recognized. In all this treatment, absolute cooperation of the patient over a long period is necessary to obtain satisfactory results and to control the effects of heretofore unrecognized allergenic influences, as well as the effects of changes in seasons and weather. The allergist must act as the policeman to hold the patient to all necessary restrictions and precautions.

Indications for Surgical Therapy: In cases of nasal allergy surgical therapy is indicated when there is actual nasal obstruction which is not due to allergic edema. This is especially true in cases of polypi and of cystic or polypoid degeneration of the turbinated bones. Definite infection in the sinuses, particularly the antrums, and especially from apical infection of a tooth, must be dealt with surgically. Usually, except in cases of acute infection, operation should be performed only after allergic study and therapy have been carried out. With the full cooperation of an allergist, the rhinologist can usually obtain better results, and much surgical treatment which seemed necessary in past years can now be avoided. If it is remembered that in most cases nasal blocking associated with so-called vasomotor rhinitis is due to allergy and proper allergic therapy is instituted, the patient can usually be spared subjection to shrinkings and intranasal treatment. Long-standing nasal allergy, however, as has been stated, produces structural changes, irreversible in type, which are greatly benefited by surgical treatment after allergic treatment is well established. This opinion is held by most allergists and by an increasing number of rhinologists. Hansel [5] recently stated that he found it advisable to do various intranasal and sinus operations in only 25 of 220 cases of nasal allergy.

The same attitude toward surgical intervention on the nose and sinuses in treatment of bronchial asthma is increasingly evident. My experience [1] agrees with that of Hansel,[3] Vaughan [8] and most other allergists in that operation on the sinuses has failed, except in isolated instances, to relieve bronchial asthma. The favorable results in certain reports have not been checked by sufficiently prolonged follow-ups, and the effect of nonspecific hyposensitization and of the absorption of injured and necrotic tissue has received little consideration. When inhalant and ingestant allergens are adequately considered in the treat-

8. Vaughan, W. T.: Allergy and Applied Immunology, ed. 2, St. Louis, C. V. Mosby Company, 1934.

ment of bronchial asthma, good results are the rule. The exception is found in patients with long-standing asthma, especially when they have undergone many operations on the nose and sinuses. Even in many of these cases acceptable, and even excellent, results arise from allergic control. In treatment of both nasal and bronchial allergy, tonsils and adenoids should be removed only with the object of eradicating infection. Benefit to the allergic symptoms rarely occurs as a result of these operations, and many instances of the precipitation of potential nasal allergy and especially of bronchial asthma[1] after tonsillectomy have been reported in the literature. Of interest is the fact that decreased susceptibility to colds and to respiratory infections from the nonspecific effect of pollen or other antigenic therapy has been reported by Sternberg, Cooke, Van der Veer and Hansel and has also been observed in my own practice.

Cauterization of the Nasal Mucosa: This procedure has been recommended for fifty years or more in cases of what is now recognized as nasal allergy and bronchial asthma. Various physicians have used trichloroacetic acid, silver nitrate, phenol and alcohol,[1] and in a limited number of cases varying degrees of relief have been obtained. It seems to be of special value in the cases in which the sphenopalatine ganglions and their mucosal ramifications are in a highly irritable state so that irritating inhalations, changes in temperature or nervous states produce nasal symptoms. Its greatest value is in the cases of so-called vasomotor rhinitis in which the patients fail to receive satisfactory relief from allergic therapy. In such cases, however, the relief obtained by cauterization is usually temporary, and the challenge to continued allergic study and treatment persists.

In recent years much publicity has been given to cauterization of the nasal mucosa and to ionization with zinc, copper and other mineral solutions. The remarkable results claimed for such ionization encouraged its use by many physicians. However, no better results are obtained than with simpler methods; the discomfort after ionization is usually great, and complicating infections of the sinuses have been reported. All this, added to the cost of the machines generally advised, points to a speedy decrease in the use of ionization. It has been of varying help in cases of vasomotor rhinitis, but in this condition local cauterization is to be preferred.

OTHER ALLERGIC SYMPTOMS

Brief mention will be made of other symptoms arising from allergy which may be of interest to the specialist in diseases of the nose and throat. Duke[9] reported cases of dizziness and the typical Ménière's

9. Duke, W. W.: Ménière's Syndrome Caused by Allergy, J. A. M. A. **81:** 2179 (Dec. 29) 1923.

syndrome due to inhalant allergy. Since then, Balyeat, Malone, Yandell, Levy, Wilder, Proetz, Urbach and I [1] have observed similar cases, and such symptoms have been recorded. Allergic edema in the internal ear, its nerve tracts or its centers in the brain is probably responsible. The relief obtained by the use of Furstenberg's [10] diet suggests edema as the cause. The frequency of allergy in patients with Ménière's disease remains to be determined. Impairment in hearing from edema in the eustachian tubes or the middle ear, or even in or around the auditory nerves, may arise from allergy, especially in association with recurrent or chronic nasal allergy. To what extent allergy causes ringing and noises in the ears is uncertain. Evidence points to the frequency of otitis media in children afflicted with nasal allergy. With allergic control, the use of autogenous vaccines and the removal of infected tonsils and adenoids, the frequency of this complication is diminished in allergic patients. Dermatitis in the auditory canals, on the lobe of the ear and behind the ear may arise from allergy due to foods and inhalants. This may be a localized lesion or may be associated with eczema in other cutaneous areas. Contact allergy and infection from fungi or bacteria may also cause aural dermatitis.

Allergy as a major cause of migraine and of recurrent headache and neuralgia has been reported by Vaughan,[8] Balyeat,[11] Rinkel and Eyermann, and this claim is supported by my own studies. Edema of localized areas of the meninges or of the nerve sheaths best explains such pain. It is important to rule out other recognized causes, such as ocular disturbances, infection of the sinuses and certain toxic conditions. The fact that allergic migraine may be associated with ocular symptoms and that allergic edema of the nose at times accompanies such headaches has led to much ocular and nasal therapy, without any resulting benefit. Allergy to foods and at times to inhalants is the common cause of migraine.

In the oral cavity, food allergy and at times drug sensitizations are productive of canker sores and of soreness and inflammation of the tongue, gums and oral mucosa. Allergic pharyngitis, gingivitis and a tendency to recurrent herpes of the lips occur. The frequency of angioneurotic edema of the lips, face, tongue and pharynx and its possible fatality when it occurs in the larynx are generally appreciated. Urticaria of the pharynx, larynx, trachea and esophagus, as recorded by Jackson, may arise. Coated tongue and heavy breath, due to interference with peristalsis, burning, stinging sensations and a bitter, metal-

10. Furstenberg, A. C.; Lashmet, F. H., and Lathrop, F.: Ménière's Symptom Complex: Medical Treatment, Ann. Otol., Rhin. & Laryng. **43**:1035, 1934.

11. Balyeat, R. M.: Migraine: Diagnosis and Treatment, Philadelphia, J. B. Lippincott Company, 1933.

lic taste in the mouth, afflict some patients with gastrointestinal allergy. A severe result of drug allergy has been recognized in agranulocytic angina, which probably is fundamentally due to sensitization in the cells of the bone marrow. Allergic purpura due to food or drug sensitizations arising from allergy in the bone marrow, or possibly in the platelets themselves, may produce hemorrhages of the mucous membrane. It is also probable that unusual nasal bleeding arises from increased capillary permeability due to an underlying allergy. Finally, recurrent swellings of the salivary glands, especially of the parotids, arising from allergy, have been observed in my work [1] and recorded in the literature. All these possible manifestations of allergy stress the necessity for its constant consideration in practice.

CONCLUSIONS

1. Nasal allergy is responsible in practically all cases for so-called hay fever, vasomotor rhinitis, paroxysmal rhinorrhea, nasal neurosis, spasmodic coryza and perennial hay fever.

2. Vasomotor rhinitis which does not respond to careful and adequate allergic diagnosis and therapy may be due to unrecognized or undiscovered allergens or to other factors unknown.

3. When nasal allergy is suspected, examination of the mucus for eosinophils should be a part of the routine.

4. Surgical intervention in patients with nasal allergy should be resorted to only to remove obstructions not due to allergic edema or to control actual infection. Adequate allergic study and treatment for several weeks or longer should precede such intervention.

5. Ionization of the nasal mucosa should be discouraged.

6. The frequency of allergy as a cause of migraine, recurrent headaches, dermatitis of the auditory canals, canker sores and, occasionally, recurrent dizziness must be remembered.

490 Post Street.

USE OF THE HYOID BONE AS A GRAFT IN LARYNGEAL STENOSIS

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The whole subject of laryngeal stenosis is a complicated one. Each case requires individual study, and particular problems in treatment must be dealt with to obtain a cure. At best, the condition is tedious and difficult, often requiring treatment over a long period—from months to years. Even then, the final result may not be as good as desired.

For many years the greatest number of the patients have been children, the condition arising secondary to improperly performed tracheotomies, as has been so often emphasized by Dr. Chevalier Jackson. Through his efforts, surgeons have been gradually instructed in the proper method of performing a low tracheotomy, and the disease is fortunately becoming more rare.

Another factor which has contributed greatly to the decrease in the incidence has been the advancement in the treatment of laryngeal diphtheria. The brilliant results of prophylactic treatment of this disease with toxoid, the great interest shown by state health departments in the control of diphtheria and the establishment of modern quarantine hospitals, with staffs trained to administer large doses of antitoxin intravenously when necessary in cases of severe involvement, have been among the outstanding triumphs of modern preventive medicine. In such hospitals, when serious laryngeal involvement develops a successful intubation can be quickly performed, obviating the necessity of a tracheotomy, with its possible disastrous after-effects of laryngeal stenosis. So members of the medical profession can look to the future with assurance that this complicated condition will occur less and less frequently.

However, with the desire for fast transportation in airplanes, with the use of millions of automobiles and other conveyances, accidents are proportionately increasing. Injuries to the larynx are common. Lacerations are often deep, with resulting deformity and stenosis. Consequently, cases of this type have now become one of the most important problems in treatment.

In June 1937 a patient was sent to the hospital with a history of having sustained a severe injury to his larynx in a railroad accident. On admission to the hospital, the patient was wearing a tracheotomy

Read at the Sixtieth Annual Congress of the American Laryngological Association, Atlantic City, N. J., May 2, 1938.

tube and was suffering with a badly lacerated larynx. In planning his treatment, I could see clearly that some sort of graft would be helpful in this particular case. The thought occurred to me that it might be possible to make some use of the hyoid bone as a graft in such a condition. So, after experimenting on a cadaver, I performed successfully the operation presently to be described. The patient's convalescence was greatly shortened, and a satisfactory airway was established more quickly than had been expected.

Since that time this procedure has been used on other patients with results which have made me feel that it is an operation worthy of reporting, even though it is a new method of treatment in the preliminary stages of development.

This operation would seem to be best adapted to the treatment of trauma to the larynx in adults. It has not been tried in children and in its present state is not suggested for their cases.

OPERATION

Anesthesia.—After using tribromethanol (avertin) to induce anesthesia for a number of years, I have found it a most satisfactory basal anesthetic for surgical intervention in the larynx. The patient goes to sleep quietly without excitement; his blood pressure is lowered; he breathes more slowly and sleeps for a longer period of time. Rectal administration of the drug keeps the anesthetist out of the way of the operation and avoids the irritating action on the respiratory mucosa so common with gaseous anesthetics. It is to be preferred to local anesthesia, as, the patient being unconscious, the operation can proceed more rapidly and there is little shock to the nervous system, a factor of importance in any surgical operation. So I now employ this method as a routine procedure in most of my cases.

Technic of the Operation.—The surface of the skin of the anterior part of the neck, from the chin above to the sternal notch below, is carefully shaved and cleansed with soap and water. This procedure can be performed in the patient's room if desired. While the patient is going to sleep on the operating table, the surface of the neck is made aseptic with alcohol, ether and iodine or with merthiolate, according to the choice of the operator. The patient is then draped in the usual manner.

As a previous tracheotomy has been necessary, the tracheotomy tube should be removed, any granulation tissue present trimmed away and the raw edges cauterized with 10 per cent solution of silver nitrate. A larger tube is then inserted and tied with tape. The neck is extended and firmly fixed with pillows or small sandbags.

A vertical incision is made in the skin, beginning above at a point on a line with the upper margin of the hyoid bone (fig. 1). This incision is carried downward, about 1 inch (2.5 cm.) to the left of the

midline of the larynx, to the lower end of the thyroid cartilage. By keeping the incision to the left, one obtains a better chance of a good blood supply to the upper surface of the graft, and it can be more securely covered over than it could be if the incised edges were directly in line with the graft. The incision should not be carried as far down as the tracheotomy opening, because it is important to retain an adherent, unbroken bridge of tissue between the laryngeal opening above and the tracheotomy wound below. With this normal area left intact, there is less possibility of contamination and infection above. The tip of the graft will also be better protected and will have a more satisfactory blood supply.

From the upper point of the incision near the center of the hyoid bone, the incision is carried horizontally to the left, on a line with the

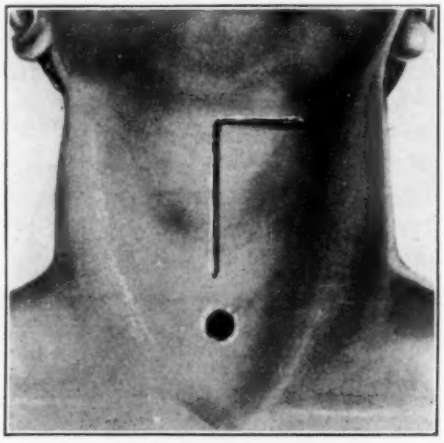

Fig. 1.—The incision in the skin extends from the lower margin of the thyroid cartilage upward to the center of the hyoid bone and then to its left tip.

hyoid bone, to its end. The subcutaneous tissue is separated, and the thyrohyoid muscle is cut across at its upper attachment. The anterior surface of the hyoid bone is then exposed throughout its entire left half. Beginning at the tip, one should free the bone from its posterior attachment with great care, for if a perforation occurs there infection from the pharynx may develop, with serious complications.

In excising this end of the hyoid bone one should make no effort to skeletonize its upper, lower and anterior surface, as some adherent soft tissue is advantageous because it gives the graft better blood supply and protection. After being freed and elevated, the end of the bone is made ready to be swung into the desired position in the larynx (fig. 2).

The bed for the graft requires particular preparation. A vertical incision is carefully made in the thyroid cartilage down to the mucosal lining, the desired amount of mucous membrane being separated from

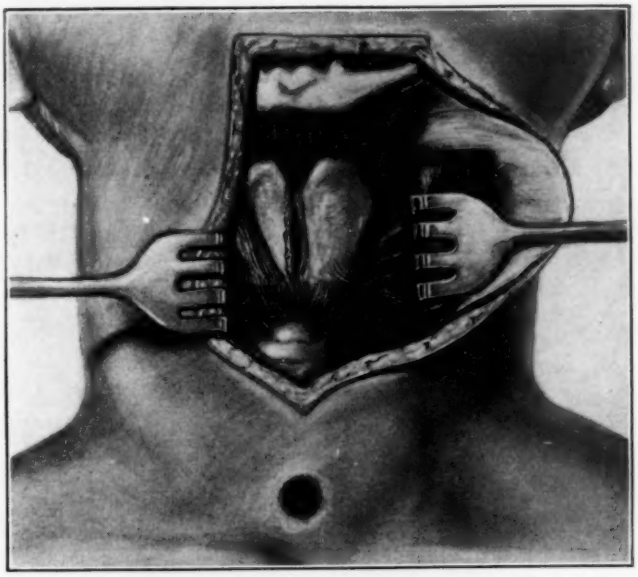

Fig. 2.—The hyoid bone is exposed, the thyroid cartilage incised and a bed made for the graft.

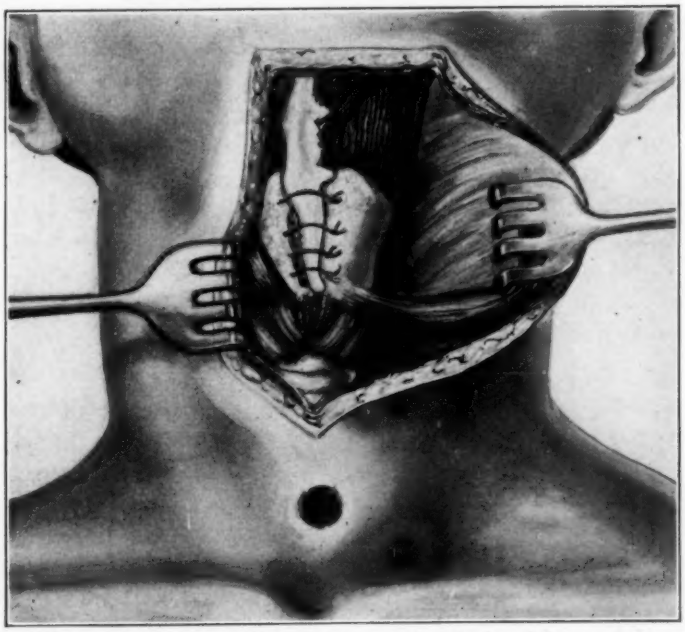

Fig. 3.—The end of the hyoid bone is rotated and placed between the separated thyroid cartilage.

the cartilage by submucous resection and every effort being made to prevent injury to or perforation of the interior of the larynx. Cartilaginous deformities, irregularities and scar tissue, when found, are corrected as much as possible.

The incised edges of the thyroid cartilage are retracted, and the end of the hyoid bone is placed between them and securely held in place with chromic catgut sutures (fig. 3).

If perforation or infection in the laryngeal area is suspected, a small rubber tube drain should be inserted at the lower point of the wound for a few days. If perforation has occurred in the hyoid region, a small rubber tube drain should be placed in the left end of the wound.

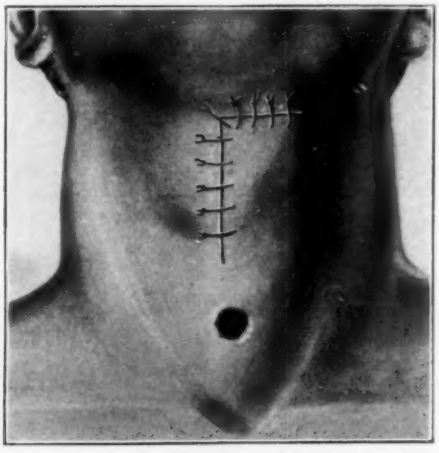

Fig. 4.—The wound in the skin is closed with fine silk.

The overlying structures are now replaced, bleeding vessels tied off and the skin closed with fine silk. The wound is covered over with rubber tissue and petrolatum gauze (fig. 4).

A feeding tube should be inserted, as in laryngectomy, to be retained for about ten days.

POSTOPERATIVE TREATMENT

This operation requires the same careful after-treatment as does laryngectomy. A suction machine should always be at the bedside of the patient. The resident should be impressed with the importance of aspirating bronchial exudate to prevent pulmonary complications. The patient's position should be changed frequently so as to lessen the possibility of bronchopneumonia. The wound should be frequently dressed, and if infection has developed more drainage may be required.

If secondary hemorrhage occurs, the bleeding point should be tied off locally if possible. Should bleeding be continuous and severe, liga-

tion of the external carotid artery can always be performed with the assurance that the hemorrhage will be controlled.

COMMENT

This operation is proposed as a method of utilizing the hyoid bone as a graft in the treatment of laryngeal stenosis in certain cases.

The principle depends on embedding the left end of the attached hyoid bone between the incised thyroid cartilage, to act as a wedge in enlarging contractures and deformities of the larynx and to permit a better airway. This firm bony graft acts as a splint to weakened and deformed cartilage. The ease with which the hyoid bone can be exposed, detached and rotated makes the procedure practical.

A living, attached and accessible graft, with the blood supply to its upper part undisturbed, has advantages over a foreign embedded graft, such as cartilage from a rib, an ear or some other part of the body.

The operation is an improvement for treatment in certain cases of laryngeal stenosis resulting from injury in adults. It is not proposed as a perfect and immediate cure-all for every patient with laryngeal obstruction and has not been tried on children.

104 West Madison Street.

NEW METHOD OF OPERATION FOR CONGENITAL ATRESIA OF THE POSTERIOR NARES

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PHILADELPHIA

Congenital atresia, or imperforation, of the posterior nares is a developmental malformation resulting in partial or complete closure of the choanae. The obstruction may be unilateral or bilateral and membranous or osseous. In my case the occlusion was complete and the partition composed of bone. Operation comprised removal of the obstructing plate and insertion of a full thickness skin graft to prevent cicatricial closure.

PATHOGENESIS AND ANATOMY

Several theories have been advanced to explain this anomaly, which the early writers attributed to an overgrowth of the bony structures surrounding the choanae. Luschka [1] said that the obstructing plate arises from a projection upward and backward of the horizontal plate of the palatal bone, while Kundrat stated that the occlusion follows an extension inward of the vertical plate of the palatine bone. Thomasson [2] expressed the opinion that the atresia is due to an extension of the plate of the vomer which becomes adherent to the lateral nasal wall. These theories, however, do not explain the clinical types of atresia which are membranous. The most accepted hypothesis today and one that might explain both types of choanal obstruction was advanced by Schaeffer.[3] In his explanation he emphasized that choanal atresia is dependent not only on the behavior of the bucconasal membranes and the primitive choanae but on the degree of absorption of the floor of the secondary nasal fossae dorsal to the primitive choanae and the degree of dorsal expansion or growth of the nasal fossae. He stated further that the extent of the resorption of the mesenchymal tissue

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Read before the Section on Otolaryngology of the College of Physicians of Philadelphia, Oct. 20, 1937.

From the Department of Otolaryngology of the Hospital of the University of Pennsylvania.

1. Luschka, H.: Ueber angeborene Atresie der Choanen, Virchows Arch. f. path. Anat. **18**:168, 1860.

2. Thomasson, W. J.: Congenital Bony Occlusion of the Right Nasal Choana, Laryngoscope **25**:221 (April) 1915; cited by Grove.[10]

3. Schaeffer, J. P.: Various Types of Congenital Atresias of the Nose and Their Genetic Interpretation, Tr. Am. Laryng. A. **56**:126, 1934.

between the nasal and the pharyngeal epithelium determines whether the atretic mass is to be membranous, osseous or both.

Facts are lacking to substantiate the hereditary nature of this interesting anomaly, but occasionally it has been shown that a connection exists between congenital choanal occlusion and some congenital defect of the adjacent facial structures. In most of the cases observed by Blair [4] the condition was associated with cleft palate, and when a unilateral cleft existed the choanal atresia was on the opposite side. Vogel [5] recorded a case in which the ala of the nose on the affected side was smaller than its fellow and lateral to it was an opening of a blind fistula. In Thomasson's [2] case there was associated congenital coloboma of

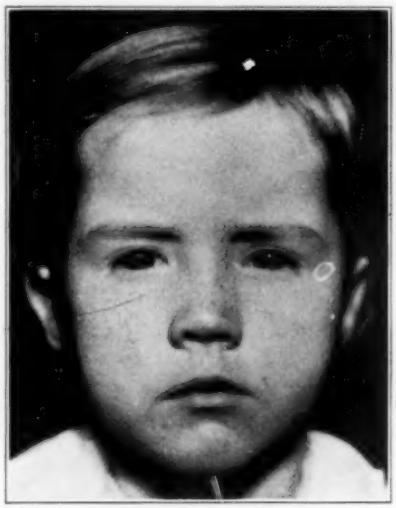

Fig. 1.—The patient, a 4 year old child. The face appears entirely symmetric, and there was no other congenital defect.

the iris, while a double tragus was found on each ear of the infant in Binnerts' [6] case. In my case the facial structures were normal (fig. 1). The usual separation of the lips is not revealed in the illustration.

A review of the anatomy of the posterior nares, or choanae, in the young child, as shown in figure 2, immediately impresses one

4. Blair, V.: Congenital Atresia or Obstruction of the Nasal Air Passages, Ann. Otol., Rhin. & Laryng. **40**:1021 (Dec.) 1931.

5. Vogel, K.: Rechtsseitige typische Choanalatresie in Verbindung mit verschiedenen angeborenen Hemmungsbildungen des Gesichts, Ztschr. f. Hals-, Nasen- u. Ohrenh. **11**:121, 1925.

6. Binnerts, A.: Einseitige Choanalatresie bei einem Säugling von drei Monaten, Arch. f. Laryng. u. Rhin. **34**:324, 1921; cited by Grove.[10]

with the small size and the oval shape of the apertures. With the posterior pharyngeal wall removed it may be noted that the roof is formed by the alae of the vomer and the body of the sphenoid bone, while the floor is represented by the line of junction of the hard and the soft palate. The vomer, or posterior edge of the septum, is shown as the medial boundary, and the lateral walls are limited by the medial plates of the pterygoid processes of the sphenoid. The drawing, while a trifle magnified, represents the vertical and the transverse diameters, about 1 cm., of the choanae of a child 3½ years old, or only six months younger than my patient. It may be stated that the equality of the

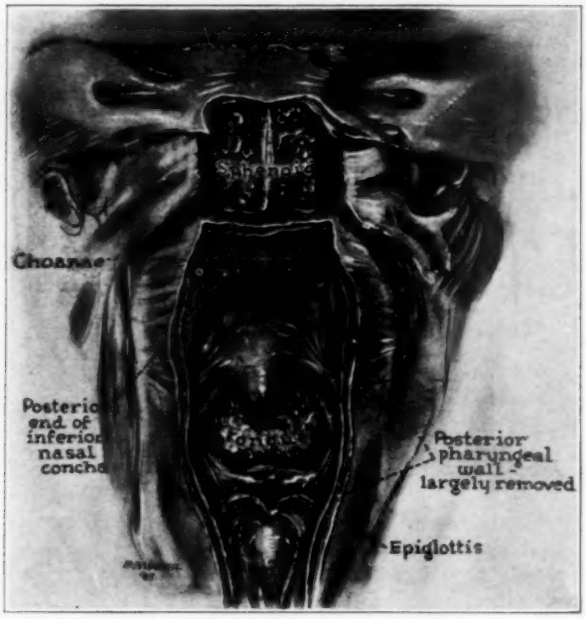

Fig. 2.—The pharyngeal cavity, exposed from behind, of a child 3½ years old.

diameters is maintained during the first decade of life, and this anatomic fact may be used to advantage in cases of choanal occlusion in which plastic repair is contemplated.

HISTORY AND INCIDENCE

Otto,[7] in 1829, while performing a necropsy, was the first to discover congenital choanal obstruction, and almost a quarter of a century passed before the first clinical case, in a boy 7 years of age, was reported by

7. Otto, A. W.: A Compendium of Human and Comparative Anatomy, translated by J. F. South, London, B. Fellowes, 1831.

Emmert. In the fifty years following Otto's discovery only 17 cases were recorded in the literature, in 15 of which occlusion was complete. The collection made by Hubbell [7a] showed that in 8 the condition was bilateral and in 7 unilateral. The atresia was bony in 12 and membranous in 5. In twenty-five more years a few more than 100 additional cases were recorded, and these were reviewed by Fraser [8] in 1910. In two thirds the obstruction was unilateral and in 90 per cent bony. This predominance of the osseous type of occlusion over the membranous was substantiated by Lebensohn,[9] who reviewed the case reports in 1923. Four years later Grove [10] estimated that the total number of all cases of choanal atresia did not exceed 180. Since 1927 about 32 cases have been added, which brings the total to date to approximately 212. To recapitulate, approximately 200 cases have been recorded during the last fifty years. Last year 6 case reports were published by Anderson.[11] These represent the total number of cases at the Mayo Clinic during the last thirty years, and it is significant that 5 of them were observed during the last decade. Of the total 32 cases collected since 1927, 14, or nearly one half, were recorded in the past two years. These figures tend to show that atresia of the posterior nares is meeting with more general recognition and that in the near future the incidence will probably be much higher.

DIAGNOSIS

The symptoms and the problem of diagnosis of choanal occlusion vary with the type of atresia and the age of the patient. In the newborn the difficulty in breathing becomes alarming if the obstruction is bilateral, but the symptoms of severe dyspnea and cyanosis disappear when the infant begins to cry. With the mouth open oxygenation is reestablished, but the impelling instinct of nasal breathing soon asserts itself, and when the mouth closes there is a repetition of the dyspnea and cyanosis. Richardson [12] referred to the "cyclic" character of this type of dyspnea and commented on the desirability of obstetricians' recognizing it. When the choanal obstruction is present on only one side respiratory embar-

7a. Hubbell, A. A.: Congenital Occlusion of the Posterior Nares, Buffalo M. & S. J. **26**:5, 1886.

8. Fraser, J. S.: Congenital Atresia of the Choanae, Brit. M. J. **2**:1698, 1910.

9. Lebensohn, J. E.: Congenital Atresia of Postnasal Orifices, Ann. Otol., Rhin. & Laryng. **32**:1128 (Dec.) 1923.

10. Grove, W. E.: Choanal Atresia and Sinus Infection, Arch. Otolaryng. **6**:237 (Sept.) 1927.

11. Anderson, C. M.: Congenital Occlusion of the Choana, J. A. M. A. **109**: 1788 (Nov. 27) 1937.

12. Richardson, C. W.: Congenital Atresia of the Post-Nasal Orifice, Lancet **2**:439 (Aug. 15) 1914.

rassment is not conspicuous but may manifest itself at nursing time. The occasional difficulty in breathing observed during nursing is often attributed to an enlarged thymus, and, though roentgen treatment fails to give relief, further diagnosis is usually not attempted. With the nursing period past the impairment in breathing is no longer noticed and the problem seems solved. Only in childhood or in later years is advice sought for unilateral choanal atresia. In the adult the obstruction to respiration is usually the presenting symptom, and the nasal discharge assumes a secondary role. In young children the reverse is true, and the constant nasal discharge is the predominating sign. Many observers have referred to the characteristics of the nasal secretion when the choanae are occluded. Richardson claimed that the excessive and annoying thick clear albuminous exudate is almost pathognomonic of postnasal obstruction, while Kirby commented on the peculiar bluish glairy appearance of the secretion. Grove [10] said that in adults the exudate is tenacious and cannot be expelled from the nose. Other prominent findings are atrophy of the turbinate bones, with hypertrophy of the overlying mucous membrane, as described by Stewart.[13] The atrophied conchae make the affected nostril appear larger, but this asymmetry is more apparent than real, as was demonstrated in the roentgen studies of Lebensohn.[9] In the young child the mucosal and the bony changes are not so marked and may be overlooked as a diagnostic sign.

The question of diagnosis would be simplified if the possibility of congenital nasal occlusion was kept in mind, but one is occasionally off guard and falls into error. The pitfall in the diagnosis arises when the chronic nasal discharge, often green or yellow, is misconstrued as evidence of chronic disease of the paranasal sinuses. This was true in my case and in the case of Grove, in which the roentgenogram showed sinal abnormality.

The diagnosis may be confirmed by passing a probe through the nose and gently sounding the obstructing wall. Others have used a small rubber bulb syringe or a Politzer bag and carefully forced air through each nasal passage. Roth and Geiger [14] suggested filling the obstructed passage with fluid and watching to see whether it flows to the nasopharynx. For adults and for some children the diagnosis can be confirmed with the nasopharyngoscope, but in all cases of bony occlusion asymmetry can perhaps be demonstrated in the roentgen shadows of the choanae, as in my case.

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13. Stewart, J. P.: Congenital Atresia of the Posterior Nares, Arch. Otolaryng. **13**:570 (April) 1932.

14. Roth, J. H., and Geiger, C. W.: Congenital Osseous Occlusion of the Posterior Choanae, Ann. Otol., Rhin. & Laryng. **35**:849 (Sept.) 1926; cited by Colver.[19]

OPERATIVE PROCEDURES

The surgical relief of congenital atresia has been the accepted method of procedure ever since Emmert, in 1853, operated on the first patient, a boy of 7 years. A curved trocar was used to break down the occluding wall, and this technic was probably followed until 1885, when von Schrötter [15] began employing the galvanocautery. His patient, a girl of 19, had bilateral osseous atresia and was operated on successfully with a burr and cautery. During the following years many types of trephines and drills driven by electric motors were devised to cut through the bony plate along the line of attachment to the vomer. Then a different method of approach, by way of the nasal septum, was advocated by Uffenorde.[16] His operation consisted in raising the mucoperiosteum of the septum down to the obstructing plate, from the anterior surface of which the mucoperiosteum was separated until the outer border of attachment was reached. The flap was thrown outward and the bony obstruction removed by chisel and curet. The flap was then replaced, and an incision was made vertically through it as it covered the nasal surface of the obstruction. After an expanding forceps was introduced through the incision the redundant mucoperiosteal flap was made to fit and to cover the whole margin of the wound in the bone. This method had some popularity, and Richardson thought it ideal. Later surgeons, however, discarded it because of the difficulty in carrying the mucoperiosteal flap over the surface of the obstruction. Stewart in 1931 found it exceptionally difficult to perform in a child of 15, and after 2 of his 3 operations he noticed that he had made the choanal opening in the posterior part of the septum, while the obstructing plates were left in situ.

The operation of choice today consists in removing the obstructing wall and then taking away the posterior part of the vomer. White [17] found this method practicable after an unsuccessful experience with the Uffenorde technic. In 1918 he described the operation, only to find out later that a similar procedure had been recommended a few years before by Katz [18] and associates.

15. von Schrötter, L.: Ueber angeborenen knöchernen Verschluss der Choanen, Monatschr. f. Ohrenh. **19**:97 (April) 1885; cited by Colver.[19]

16. Uffenorde, W.: Ein Fall von Choanalatresie mit Demonstration, Ztschr. f. Laryng., Rhin. **1**:475, 1908.

17. White, L. E.: Occlusion of the Posterior Nares, Laryngoscope **28**:571 (Aug.) 1918.

18. Katz, L.; Preysing, H., and Blumenfeld, F.: Handbuch der speziellen Chirurgie des Ohres und der oberen Luftwege, Würzburg, Curt Kabitzsch, 1911-1913, vol. 3, p. 432; cited by Colver.[19]

During the past twenty years this method has met with varied success, as the more detailed and instructive reports testify to the perplexities of maintaining a choanal opening. One of Colver's [19] patients was an infant only 6 days old with bilateral osseous atresia. The surgical procedure comprised reaming the choanae to normal size and then with a small rongeur forceps removing a portion of the vomer. Small pieces of rubber tubing were then introduced into the nostrils and left in place for a few days. Observation a few months later showed the right choanal opening apparently normal while the left side was somewhat stenosed. A secondary operation was contemplated. One might infer that the problem of preventing cicatricial stenosis is less difficult in the older child and the adult, in whom a larger choanal orifice is to be found. It appears, however, that this is not the case. Kearney [20] experienced difficulty in maintaining patency in a 14 year old child. This girl had unilateral bony atresia, and after the obstruction was removed the posterior edge of the septum was bitten away. The surgeon then inserted a piece of gauze after the method of Brady [21] into the side operated on. The gauze was caught in the nasopharynx and drawn through the opposite side, and the ends were tied around the columella. The knot was untied daily, and a fresh strip of gauze was attached to one of the free ends. The fresh gauze was then pulled through the nose and tied as before. The procedure proved very painful and had to be abandoned. Three weeks afterward the choanal opening had closed, necessitating a secondary operation, which included a submucous resection of the nasal septum. Even in the adult cicatricial stenosis occurs, as was evident in the woman operated on by Lebensohn. In this case the posterior naris had closed six months after the operation, and if the opportunity presented itself Lebensohn planned to do a resection of the nasal septum to secure a permanent passage.

It is evident from the foregoing experiences with this method of removing the posterior edge of the septum with the obstructing plate that overcorrection is needed at the time of the primary operation and that more of the septum should be removed to insure postoperative patency. While no harm may follow in the adult, it is questionable whether or not a more elaborate extirpation of tissue would be advisable in the infant or the young child.

The method of simply removing the obstructing plate and inserting a skin graft on an obturator, as presented here, offers a new approach

19. Colver, B. N.: Congenital Choanal Atresia: Two Cases of Complete Bilateral Obstruction, Ann. Otol., Rhin. & Laryng. **46**:358 (June) 1937.

20. Kearney, H. L.: Congenital Bony Atresia of Right Posterior Naris, Ann. Otol., Rhin. & Laryng. **45**:583 (June) 1936.

21. Brady, A. J.: Atresia of the Choanae, J. Laryng., Rhin. & Otol. **33**:49 (Feb.) 1918.

to a tedious problem. For children it has the particular advantage of precluding the necessity of postoperative instrumentation. For the adult the principle may be successfully modified, as was demonstrated by Dr. Albert D. Davis,[22] of San Francisco, who suggested the method described in this report. His patient, a woman of 25, had unilateral bony atresia, which he removed with rat-tail file and chisel. He then inserted a skin graft on a large catheter. After healing, a catheter attached to silver splints was kept in the nose for two and one-half months. Blair [4] was the first to suggest the use of a skin graft to maintain postoperative patency. He employed this method in a case in which he chiseled through a solid piece of bone to make an artificial nasal cavity.

REPORT OF A CASE

A girl aged 4 years, alert and inquisitive, referred by Dr. H. J. Lenahan on Aug. 18, 1936, had had a discharge from the right side of the nose since birth. As a rule it was colorless, but on several occasions, especially during the winter, it had a distinctly greenish tint. She experienced difficulty in blowing the nose, and during sleep her breathing was of a snorting character. Nursing at the breast was often interrupted by a peculiar type of breathing, which would disappear after she had taken a few large gasps of air through the mouth. The family physician attributed this irregular breathing to an enlarged thymus, but roentgen therapy proved of no avail..

At 5 months she had pneumonia, and during the following eighteen months contracted pertussis, measles and chickenpox. There was no evidence of a congenital anomaly in the father, the mother and the two older brothers.

Examination revealed a thick, slightly greenish discharge on the floor of the right fossa. The mucous membrane was a little paler than normal, and the part covering the anterior tip of the inferior turbinate bone was hypertrophied to the extent of showing mulberry-like dimpling of the mucosa. There was no perceptible atrophy of the concha. The left fossa had a normal mucosal lining and was free from any secretion. The child was seen on only two occasions, and her apprehension made the use of a nasopharyngoscope inadvisable. Both tympanic membranes were normal, and there was no impairment of hearing. The faucial tonsils showed moderate hypertrophy, and the palatal arches were symmetric. The voice had a distinctly nasal twang.

It was thought after the initial examination that either syphilis or suppurative sinusitis was present. On the second examination the mother presented a report from the family physician to the effect that he was unable to secure a specimen of the child's blood but that the mother's Wassermann reaction was negative. Roentgen study of the sinuses pointed toward infection of the ethmoid cells and the right maxillary sinus, with chronic thickening of the mucosa along the nasal wall of the antrum.

In view of the thick greenish nasal exudate and the roentgen finding of sinal abnormality it was decided to improve nasal ventilation by removing the hypertrophied tonsils and adenoids. After operation a nasal Sinnexon dilator was passed through the nostrils only to meet with firm resistance on the right side posteriorly.

22. Davis, A. D.: Personal communication to the author.

After shrinking the nasal mucosa I made an examination of the obstructing area. No mass was discernible on the posterolateral wall, and the choanal occlusion appeared to be immediately continuous with the posterior tip of the middle turbinate bone. The nasopharyngoscope could not be passed into the nasopharynx. On digital examination of the nasopharynx I was unable to find any opening into the right choana. The obstructing wall was composed of a smooth hard plate of bone immediately within the free posterior border of the septum. After separating the blades of the nasal dilator, I passed one blade through the right nostril and with considerable pressure, comparable to that used in making an antral puncture, perforated the obstruction. A diagnosis of congenital atresia was made, but no surgical procedure was attempted, as the blood for the Wassermann test was not obtained until just before the operation.

The patient returned home, and for one month a local rhinologist kept her under observation. The opening in the choana soon closed, and on October 12, the patient was admitted to the Hospital of the University of Pennsylvania, where medical studies were supervised by Dr. J. Claxton Gittings and the immediate rhinologic problem delegated to me under the service of Dr. George M. Coates.

At this time particular note was made of the nasal characteristics of the patient's voice, which was classified as having typical rhinolalia clausa, and my associates and I were able to demonstrate this quality on a phonograph record. The child was unusually alert and her intelligence quotient well beyond the normal. The general physical examination gave essentially negative results. Roentgen study of the chest showed nothing abnormal, and an electrocardiographic examination revealed simple tachycardia. The Kolmer and the Kahn test were negative, and the blood count was normal.

The routine roentgenogram of the posterior nares (fig. 3) is an unusual study showing confirmatory evidence of osseous occlusion of the right posterior naris. Dr. Eugene P. Pendergrass, roentgenologist, reported as follows: The posterior naris on the left side is patulous, as is shown at *A*. The posterior naris on the right side is definitely different from that on the left, and there is a suggestion of bony abnormality. This side was known to be clinically obstructed, and it is suggested that such variance in the appearance of a posterior naris may in the future be regarded as roentgenographic evidence of bony occlusion. Normally the posterior nares in this projection look symmetric, and there is no large amount of space between. In this instance, however, there is a considerable space, seen at *C*.

That the occlusion was complete is evident from a similar coronomental view of the right posterior naris after injection of iodized poppyseed oil, as shown in figure 4. Despite the complete obstruction of the right choana, the sinuses on that side appear normal in a posteroanterior projection, as shown in figure 5, and their development is equal to those on the left, or unobstructed, side. The frontal sinuses show early development. This figure, in which the absence of sinal abnormality is apparent, is not to be confused with the primary roentgen study, not shown here, which pointed toward ethmoidal and antral pathologic changes on the right side.

In order to make the interpretation of the shadows cast by the normal posterior nares, or choanae, more evident we utilized for demonstration the cadaver from which the drawing in figure 2 was made. Figure 6 shows a piece of lead occupying the entire left choana. The floor, or the junction of the hard and the soft palate, is shown at *A*. The roof appears projected posteriorly and is shown at *B*.

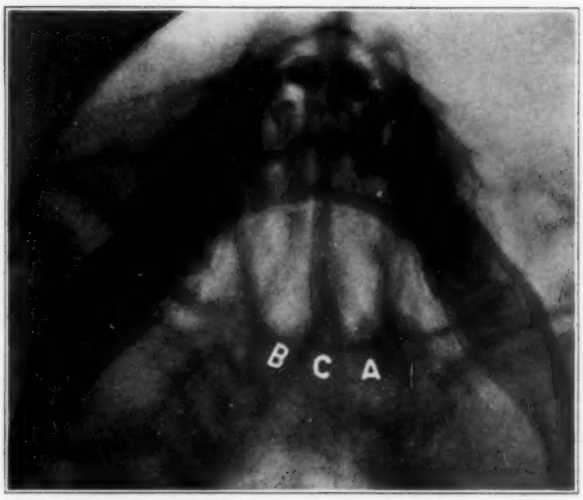

Fig. 3.—Coronomental view demonstrating the roentgen changes in the right posterior naris. *A* indicates the patulous naris on the left side and *B* the occluded naris on the right side. Note the absence of normal symmetry of the nares and the unusually large space at *C*.

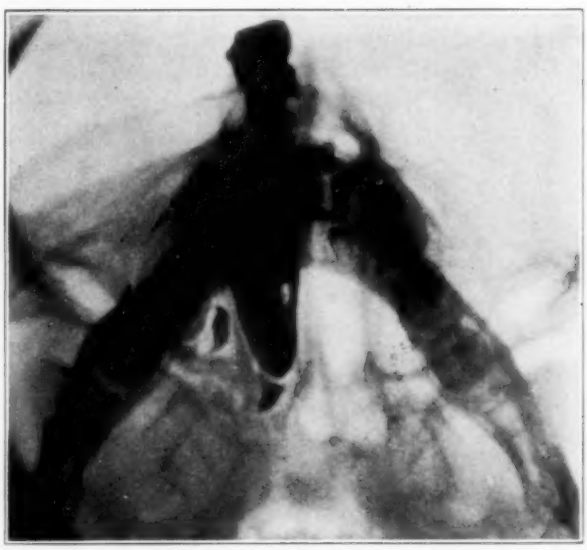

Fig. 4.—Coronomental view taken after the injection of iodized poppyseed oil, demonstrating the obstruction in the right posterior naris.

Fig. 5.—Posteroanterior view demonstrating the apparently healthy paranasal sinuses.

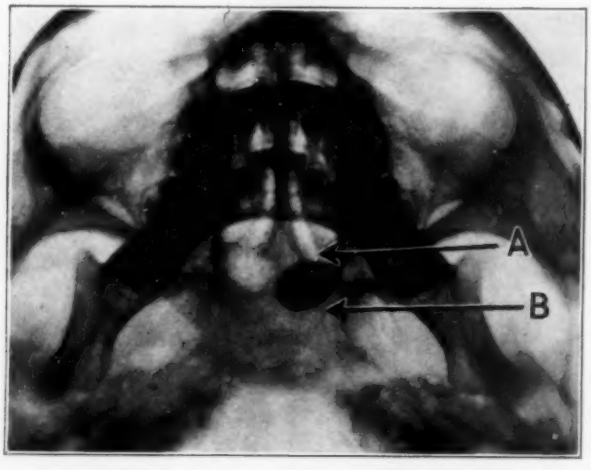

Fig. 6.—Coronomental view of a cadaver, showing the shadows cast by the normal posterior nares. A piece of lead outlines the walls of the left choana. The nares are symmetric.

Operation.—On November 3, after the patient was anesthetized with divinyl ether, the nasal mucosa was well shrunk with a solution of 4 per cent cocaine hydrochloride and 1:1,000 epinephrine. The choanal obstruction was first perforated with a nasal Sinnexon dilator, and then a few pieces of the bony wall were removed with a small biting forceps and saved for histologic study. The larger end of a Faulkner curet proved ideal for breaking down the remaining thin bony partition. To guard against instrumental injury of the adjacent parts, the rotary movements of the curet were guided by the index finger placed in the nasopharynx. The diameter of the curet, 1 cm., was a tangible guide in determining the proper size to make the choana before inserting the obturator and skin graft. Dr. Julius Johnson removed a full thickness skin graft 2.5 cm. square from the child's abdomen, and this was trimmed down to fit snugly around a no. 18 French woven catheter, which previously had been measured to equal the length of the nasal fossa from the anterior to the posterior naris. The skin graft circling the posterior end of the rubber tubing measured from 1.5 to 2 cm. in width and was attached to the catheter to prevent slipping by two no. 00 catgut sutures. The rubber obturator was then inserted along the floor of the nose until it reached the guiding finger in the nasopharynx. The raw surface of the graft was then in contact with the freshly denuded area of the choana. A silk suture was placed in the anterior end of the catheter, which remained immediately within the nostril, and the projecting end of the tie was anchored to the cheek by adhesive tape.

The tissue of the occluding wall removed at operation, a section of which is shown in figure 7, was studied at the Pepper laboratory by Dr. Herbert A. Fox, who reported as follows: There are pieces of poorly constructed bone and cartilage. The bone is probably normal, but in two places it is combined with loose fibrillar tissue, the identity of which is not clear. No distinct marrow elements can be seen. There is no suggestion of a syphilitic inflammation or of tumor.

The postoperative care consisted of frequent nasal instillations of 1:5,000 metaphen solution. The French woven catheter was removed on the tenth day, and my misgivings were allayed when the skin graft was found to be adherent to the choana. A slight odor and discharge on the affected side increased during the following week. The discharge became very rancid and presumably arose from the retained secretion in the sweat and sebaceous glands of the skin graft. During the third week the exudate decreased, and the child was discharged from the hospital on November 29.

After eleven months there was no evidence of nasal secretion and the patient was able to breathe comfortably through the right side of the nose. The snorting at night had disappeared, and, with general improvement in her appearance, she had gained 6 pounds (2.7 Kg.). The choanal opening was estimated at 6 or 7 mm. in diameter, or large enough for a Holmes nasopharyngoscope to be passed. The patency is demonstrated in figure 8 with a eustachian catheter. While the voice had not returned to normal, noticeable improvement had been recognized by her family and friends. We were able to demonstrate this change on the opposite side of the phonographic record which eleven months ago had recorded her rhinolalia clausa type of speech.

Fig. 7.—A section from the excised diaphragm, showing calcified matter and fibrous tissue on each side. The mucosa had been mechanically disturbed.

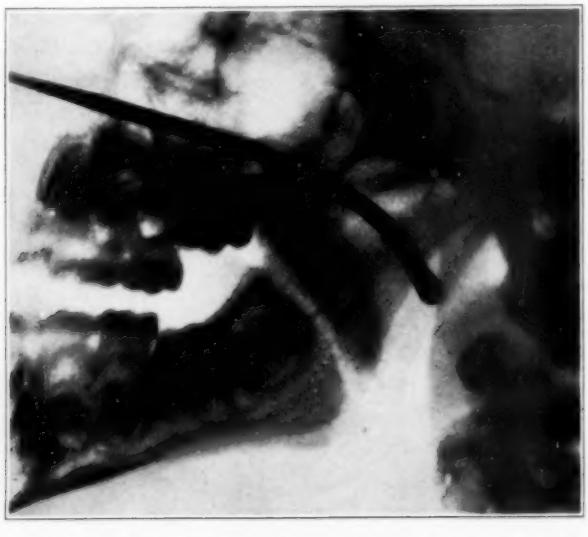

Fig. 8.—Lateral view of the nasopharynx made nine months after operation, demonstrating the patency of the right posterior naris.

CONCLUSIONS

This case suggests the advisability of exploring the nasopharynx and the choanae with a finger or instrument during all operations on the nose or throat in children.

When there is chronic unilateral nasal discharge the possibility of choanal obstruction should be kept in mind.

As an aid to diagnosis roentgenography may be used to advantage.

The perplexing problem of postoperative cicatricial stenosis was overcome in this case by the use of a whole skin graft.

The patency of the posterior naris one year after operation was interestingly demonstrated by the improved resonance of the voice as recorded on a phonographic disk.

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Abstracts from Current Literature

Ear

VERTIGO IN BRAIN TUMORS, WITH SPECIAL REFERENCE TO THE RESULTS OF LABYRINTH EXAMINATION. E. A. SPIEGEL and A. ALEXANDER, Ann. Otol., Rhin. & Laryng. **45**:979 (Dec.) 1936.

The observations of Spiegel and Alexander on tumor of the brain seem to corroborate the assumption of a representation of the labyrinth in the cerebral cortex, particularly in the temporal lobe. Parts of the frontal lobe, especially the centro-opercular region, must be taken into consideration as places at which vestibular and spinal impulses joined in the subcortex (cerebellorubral system) may enter. The concept that vertigo in association with tumor of the brain is only a general symptom of increased intracranial pressure seems to need revision. In a large number of cases symptoms of choked labyrinth, hyperexcitability of this organ, differences in excitability between the two sides, nystagmus, diplopia and cerebellar disturbances are found, and the appearance of vertigo is explainable as due to these effects of increased intracranial pressure. Yet there remains a group of cases in which such an effect of pressure on the labyrinth or on the brain stem is absent. In these cases, at least, it seems not unreasonable to assume that the vertigo may appear as a local symptom of the cerebral cortex due to direct lesion (stimulation) of the aforementioned cerebral areas or to pressure on these foci by a tumor in a neighboring region. In general, it seems that a tumor close to the sylvian fissure induces vertigo more easily than does a tumor more distant from this fissure.

EDITOR'S ABSTRACT. [J. A. M. A.]

STREPTOCOCCIC DERMATOSES OF THE EARS. JAMES H. MITCHELL, J. A. M. A. **108**:361 (Jan. 30) 1937.

According to Mitchell, many of the eczematous eruptions in and around the ears are due to the invasion of streptococci. He agrees with the opinion of Sabouraud, who named such manifestations *Streptococcides eczématiformes.* Besides causing a retroauricular intertrigo, the streptococci may cause the formation of scaly, exudative patches in the cavum and in the canal. Itching is a common complaint. The diagnosis must be verified by laboratory tests. Streptococci may be readily demonstrated in serum from fissures and in the squama-like crusts. Cultures are more difficult to make, and Mitchell advocates the use of brain broth–dextrose medium in tubes at least 12 inches (30.4 cm.) long. In the cases described by Mitchell no fungi were observed, and the possibility of external irritants was excluded.

LEWIS, New York. [ARCH. DERMAT. & SYPH.]

SURGICAL TREATMENT OF MENINGITIS OF OTITIC AND NASAL ORIGIN. G. E. SHAMBAUGH JR., J. A. M. A. **108**:696 (Feb. 27) 1937.

During the last four years Shambaugh Jr. observed 8 cases of meningitis of otitic or nasal sinus origin in his practice and in the house service of the Presbyterian Hospital. Two patients died of sepsis (1 of thrombosis of the lateral sinus and the other of thrombosis of the superior sagittal sinus), and 1 patient, of duodenal hemorrhage. The meningitis in these 3 cases was localized and was not the immediate or the contributory cause of death. The remaining 5 patients with meningitis were treated successfully according to the accepted principle of making the earliest possible diagnosis by examination of the spinal fluid at the first suspicion of meningeal invasion. The cell count is the important consideration. A sharp differentiation must be made between localized meningitis, with an increased number of cells but no organisms on smear or culture and a

normal sugar content, and generalized meningitis, with organisms on smear and culture and diminution or absence of sugar. As long as the meningitis is localized, treatment should be confined to thorough surgical drainage of the focus in the ear or the sinus. Occasionally a few organisms may be observed on smear but not on culture, and here simple drainage of the suppurative focus may suffice to produce a cure. The prognosis in localized meningitis is good if the disease is recognized promptly and dealt with. Once generalized meningitis has developed, incision and drainage of the dura at or near the point of entry of the infection may be considered; forced drainage of spinal fluid by the method of Kubie may be employed; the intracarotid administration of antiseptics may be tried, or simply repeated lumbar punctures may be relied on. While the prognosis for generalized meningitis of otitic or nasal sinus origin is usually poor, occasionally recovery does occur, especially when the meningitis is due to the streptococcus.

EDITOR'S ABSTRACT. [ARCH. NEUROL. & PSYCHIAT.]

A STUDY OF MASTOID INFECTION IN CHILDREN. M. HINES ROBERTS, South. M. J. **29**:1207 (Dec.) 1936.

Many mastoid infections do not require surgical treatment. Persons with such infections frequently present clinical and roentgenographic evidence practically identical with that for patients who finally come to operation.

Even when destruction and necrosis are shown by roentgen examination to be taking place in the mastoid, recovery may occur without operation.

Conservative treatment of all patients is recommended, and the author disproves the old idea that early operation for acute involvement of the mastoid is essential to avoidance of grave complications.

The time element is most important in evaluating all clinical laboratory data. The postponement of operation for one, two or even several days will not endanger the patient and will in most instances obviate the need for surgical intervention.

It is most imortant to have close cooperation between otologist, roentgenologist and pediatrician, and there should be careful daily comparison of evidence by these three specialists.

SCHLUTZ, Chicago. [AM. J. DIS. CHILD.]

THE PREVENTION OF ACUTE SURGICAL MASTOIDITIS. WELCH ENGLAND, West Virginia M. J. **32**:560 (Dec.) 1936.

A certain percentage of infections of the middle ear will heal spontaneously. A certain percentage will go on to mastoiditis, regardless of any or all conservative methods of treatment. Between these two extremes lie the great majority of conditions that confront the otologist.

The author discusses the various causes of mastoiditis and concludes that in about 98 per cent of cases the condition follows an acute infection of the nose and throat, ascending by way of the eustachian tubes.

In most cases the patient is in the age group from 8 to 16 years. With temperature ranging from 99 to 105 F., profuse perspiration, draining of the ears and visible clouding of the mastoids under roentgen examination, there is undoubtedly acute mastoiditis, but just as certainly the patient is septic and should not be operated on. A leukocyte count of about 15,000, associated with a shift to the left of the Schilling differential count still indicates a complicated septic form of infection of the upper part of the respiratory tract. A patient should not be operated on at the time of such manifestations, but operative procedure should be delayed until there is a shift back to a more even range of temperature and a more normal Schilling-Kolmer differential count.

Caution and delay are the watchwords in this article.

SHAWKEY, Charleston, W. Va. [AM. J. DIS. CHILD.]

VENTRICULAR COMMUNICATION AND INTERNAL HYDROCEPHALUS AS COMPLICATIONS OF BRAIN ABSCESS. FRANCIS MCGUCKIN, Lancet **2**:1387 (Dec. 12) 1936.

Three cases of otogenic abscess of the temporal lobe in which recovery followed establishment of ventricular communication form the basis of this report. These cases demonstrate that tension may be severe and that its relief under certain circumstances may make for rapid recovery. In 1 case the abscess was sufficiently large to cause extensive compression of the homolateral ventricle, and the large amount of cerebrospinal fluid evacuated would point to the rupturing segment as probably the anterior horn and the adjacent part of the body.

If intervention is not delayed unduly, evacuation of the content of the abscess will usually relieve the pressure responsible for the block in cerebrospinal circulation and will accomplish this much more safely than will direct interference with the system.

LANGMANN, New York. [AM. J. DIS. CHILD.]

MASTOIDITIS IN INFANTS. H. GRENET, R. LEVENT and D. ISAAC-GEORGES, Bull. Soc. de pédiat. de Paris **34**:111 (Feb.) 1936.

Autopsy of 86 infants under 2 years old of whom aural examination had shown no abnormality during life showed involvement of one or both mastoids in 54. One hundred and fifty-five infants who had otitis media were divided into three groups: (1) those who had a discharge from the ears, (2) those who showed signs of inflammation of the ears and (3) those in whom examination of the ears revealed no abnormality even after paracentesis but in whom there was evidence of mastoid infection at autopsy. The conclusions are that all sick infants should have regular examinations of the ears; paracentesis should be done when necessary and antrotomy if it becomes necessary. The authors express the belief that when aural examination shows no abnormality mastoiditis observed at necropsy is a result rather than a cause of the infant's condition and that operation is usually ineffective in such cases.

BENJAMIN, Montreal, Canada. [AM. J. DIS. CHILD.]

LATENT OTOMASTOIDITIS AND ACUTE DEHYDRATION IN INFANTS. J. CATHALA, LORAIN and MOREL, Bull. Soc. de pédiat. de Paris **34**:505 (Oct.) 1936.

When infants with digestive disturbances and toxemia present no demonstrable cause for the illness and continue without improvement despite treatment, they may have latent mastoiditis, and antrotomy may be necessary or even life saving. An instance illustrating this statement is cited, as well as one in which bilateral antrotomy revealed no abnormality of the mastoids and necropsy showed an inflammatory condition of the pyloric canal probably associated with a duodenal ulcer. Of course, not all infants with severe diarrhea and dehydration have latent mastoid infections. Clinical diagnostic ability, which even at its greatest is not infallible, is necessary in deciding whether mastoid antrotomy is indicated.

BENJAMIN, Montreal, Canada. [AM. J. DIS. CHILD.]

NOISES IN THE EAR, TINNITUS AND ELEMENTARY, COMMON AND VERBAL AUDITORY HALLUCINATIONS. FERDINAND MOREL, Encéphale **31**:81 (July) 1936.

In classifying the heterogeneous phenomena of auditory disturbances, Morel uses the cochlear path as a guide. Peripheral noises of extraneural origin—muscular and vascular bruits—are characterized by monotony and relatively low complexity. The noises which originate in the cochlea, the primary neuron or the projection fibers from the medullary nuclei to the cortex have the same characters. They are elementary noises and have no significance and no verbal form. The patient compares his sensation to some noise such as the roar of the sea, and if he has no appropriate term of comparison he imitates it by onomatopoeia. The noises are localized subjectively near the ear, in the ear or in the head, but not in the sonorous space. Only the associated signs and symptoms can indicate the level of the lesion. An altogether different group of auditory phenomena consists

of noises which are localized externally, in the subject's sonorous space. They are defined not, as in the preceding group, by onomatopœia but by direct reference to their supposed external source. The localization follows the laws of acoustics. These noises "irrupt" into consciousness in company with nonauditory, particularly tactile and visual, elements, bringing about cohesion of the entire process and absolute, or almost absolute, belief in their reality. No gross cerebral lesion produces these phenomena. The functions involved are those which disappear in auditory agnosia. Just as auditory agnosia is generally associated with word deafness to some degree, these common auditory hallucinations are usually related to verbal hallucinations.

Verbal auditory hallucinations involve the phasic function. They depend on the patient's verbal ideation and are closely related to his character, prepsychotic habits and intentions. The voice is heard at any site, either in the patient's body or at any distance within or without the range of the normal voice. Its vocal characters are difficult to describe. The patient never imitates the voice. A general law, to which Morel has never seen an exception, is that two voices with different contents, or simply two systems of different phenomena, are mutually exclusive. They never occur at the same time, though they may alternate. It is best to observe these phenomena at the moment when they occur. In addition to inducing introspection the observer should use objective methods. They include observation of the patient's motor responses, particularly by the use of special recording technic such as cinematography of the pupil, and sensory examination. Claude, Aubry and Baruk noted the inconstancy of labyrinthine reactions in cases of paranoid dementia. Morel observed patients with chronic hallucinatory psychosis with the electric audiometer. A sudden, brief hypoexcitability almost always corresponded to an auditory verbal hallucination. Sudden disturbances in respiratory rhythm were noted by Paterson. Morel suggests the use of stroboscopic laryngoscopy and electromyography of the muscles of respiration, articulation or phonation. The importance of motor phenomena is shown by the attempts made by some patients to eliminate auditory hallucinations by inhibiting lingual and respiratory movements. One patient, accustomed to using a digital sign language, accomplished this inhibition by flexing her fingers strongly and asked that her fingers be cut off. The movements of phonation, however, are not sufficient to create verbal hallucination; a special state, summarized as automatism, must be present.

Tinnitus ordinarily has no relation to hallucination; yet in 2 patients with traumatic rupture of the tympanic membrane tinnitus was transformed into common auditory hallucination, attributed to an external cause, when ether was administered or the patient was falling asleep.

LIBER, New York. [ARCH. NEUROL. & PSYCHIAT.]

EAGLETON'S SYNDROME. F. J. COLLET and R. MAYOUX, Rev. d'oto-neuro-opht. **14**:727 (Dec.) 1936.

The case reported was that of a woman aged 56, who suffered a stroke in 1926, which was followed by paralysis of the left facial nerve. Later, violent headaches and vomiting appeared, and all the cranial nerves on the left side except the optic became involved. Examination revealed complete deafness in the left ear and no reactions to caloric tests. In the right ear hearing was normal, and the caloric test revealed marked reaction in nystagmus and vertigo from the horizontal canal but no reaction from the vertical canals.

In France it is not generally admitted that elective functional disturbance of the vertical canals exists. Hautant considered such disturbance a sign of vestibular hypoexcitability, as did Weill. Aubry and Caussé regarded it as pseudoparalysis of the vertical canals. Collet and Mayoux cannot admit that there was hypoexcitability of the right labyrinth in their case. They think the phenomenon was an elective functional disturbance of the vertical canals.

DENNIS, San Diego, Calif. [ARCH. NEUROL. & PSYCHIAT.]

IMPORTANCE OF INFLAMMATION OF THE MIDDLE EAR AND MASTOIDITIS IN INFANCY FROM THE PEDIATRIC STANDPOINT. J. CSAPÓ, Arch. f. Kinderh. **109**:203, 1936.

Inflammation of the middle ear and the connected parts can produce a variety of clinical symptoms in infancy. The following forms are distinguished: the meningeal form; otogenic sepsis and septic, toxic and septicotoxic inflammation of the middle ear; antral empyema, and mastoiditis. Infection of the middle ear is one of the most important complications of dysentery in infancy and early childhood. Correctly timed paracentesis or trepanation will aid greatly in relieving the intestinal symptoms. CRANE, Washington, D.C. [AM. J. DIS. CHILD.]

Pharynx

THE RADIOLOGICAL TREATMENT OF CANCER 1929-1935: V. CARCINOMA OF THE TONGUE. G. E. RICHARDS, Canad. M. A. J. **35**:593 (Dec.) 1936.

Richards reports the results of treatment in 101 cases of cancer of the tongue. In 73 per cent, the lesions were advanced. Healing of the primary lesion by radiologic treatment was obtained in 54 per cent. Control of the disease was obtained in 34 per cent. Richards points out that conservation of tissue is an important consideration in the treatment of lesions of the tongue and that radiologic methods are advantageous in this respect. He feels that there is an urgent need for early diagnosis and treatment.

LEWIS, New York. [ARCH. DERMAT. & SYPH.]

THE RADIOLOGICAL TREATMENT OF CANCER 1929-1935: VI. INTRA-ORAL LESIONS (EXCEPT THE TONGUE). G. E. RICHARDS, Canad. M. A. J. **35**:599 (Dec.) 1936.

Of 158 cases of carcinoma of the mouth studied by Richards, the point of origin was the alveolus in 60, the floor of the mouth in 30, the buccal mucosa in 55 and the roof of the mouth in 13. While treatment was individualized, radiologic methods were employed principally in the treatment of the primary lesions. When metastases to regional lymph nodes occurred, surgical methods were resorted to, together with roentgen or radium treatment. In 72 per cent of the cases the disease was in the advanced stage when the patient was first seen. Investigation of the results of treatment showed that 69, or 43 per cent, of the patients were alive and free from symptoms; 5 were alive but not free from the disease; 70, or 44.3 per cent, died of the disease; 10 died of extraneous diseases, and 4 were untraced. Richards stresses the advantage of early diagnosis, since of 29 patients treated during the early stage of the disease, 27, or 93.1 per cent, were cured. LEWIS, New York. [ARCH. DERMAT. & SYPH.]

EXPERIENCES WITH ROENTGEN THERAPY OF MALIGNANT EPIPHARYNGEAL TUMORS AT ROENTGEN INSTITUTE IN ZURICH. H. R. SCHINZ and A. ZUPPINGER, Ztschr. f. Hals-, Nasen- u. Ohrenh. **41**:173, 1936.

After reviewing their experiences with roentgen therapy during an earlier period, Schinz and Zuppinger report their observations in 26 cases in which they treated epipharyngeal tumor between 1929 and 1935. In discussing the clinical aspects of these cases, the authors state that in all of them the tumor was in an advanced stage of development, the majority of the patients already having metastases. Histologic studies revealed that 16 patients had carcinoma and 9 sarcoma. In 1 case histologic examination was dispensed with. The majority of the carcinomas were of the lymphoepithelial type, which the authors regard as the chief form of carcinoma of the epipharynx. The sarcoma belonged to various histologic types.

Treatment usually consisted of protracted-fractional distant roentgen irradiation. There was no palliative effect from this treatment in 6 cases, but in the other 20 cases all or some of the symptoms disappeared. EDITOR'S ABSTRACT.

Nose

OPHTHALMOLOGIC SEQUELAE IN THE RADICAL CURE OF FRONTOETHMOID SINUSITIS. P. HALBRON, Bull. Soc. d'opht. de Paris, October 1936, p. 636.

The ocular complications following operation on the frontal sinus are well known. Halbron reviews such complications in 48 cases. These are grouped as cases of (1) difficulty with motility of the globe, (2) lacrimal complications, (3) palpebral complications and (4) corneoconjunctival complications.

In 4 of Halbron's patients the complications fell in the first group. Diplopia was the leading symptom. He cautions that treatment must be delayed, as restitution may occur even as late as three months after the operation. Graphs of the muscular balance in these 4 patients are shown. Interference with lacrimation is most likely due to subcutaneous inflammation. Complications affecting the lid are frequent. Even after healing, inflammation may persist at the internal angle of the lid. Infection of the conjunctiva has been reported, but this did not occur in Halbron's cases. Keratitis without ulceration, however, was frequent.

Halbron concludes that complications may be minimized if the rhinologist keeps in mind the following points:

1. The proper incision avoids the lacrimal sac by passing under and to the side of it.

2. The periosteum of the orbit is removed except in the region of the pulley of the superior oblique muscle.

3. The lids must be held closed after the operation.

A bibliography is appended. L. L. MAYER, Chicago. [ARCH. OPHTH.]

RESULTS OF TWENTY YEARS OF OBSERVATION AND THERAPY OF OZENA. K. AMERSBACH, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **142**:106, 1936.

Amersbach surveys his own experiences and reviews the literature for the last twenty years with regard to ozena. He reviews various theories of the cause and then evaluates the different surgical methods which he himself has tried. He is convinced that no one any longer speaks of a morphologic-anatomic cure for ozena but shows that there are still some who consider clinical cure—that is, elimination of the bad odor, of the crust formation and even of the atrophy—possible. He himself takes a more critical attitude, pointing out that, although there are many different therapeutic methods, none can be said to effect complete cure, each of them at the most effecting only an improvement of the symptoms. In conclusion he stresses general treatment and the improvement of the hygienic conditions as factors in handling the disease. EDITOR'S ABSTRACT.

RADICAL OPERATION ON FRONTAL SINUS. G. HOFER and T. MOTLOCH, Monatschr. f. Ohrenh. **70**:1339 (Nov.) 1936.

Hofer and Motloch stress as important for the success of the radical operation on the frontal sinus: (1) that the diseased mucous membrane must be radically removed and (2) that the connection between the nose and the frontal sinus must be preserved at all costs. In order to insure such a connection, it is important to preserve the supporting frame of the nasofrontal duct and to make a communication between the two cavities by removing the ethmoid and the sphenoid, even in those cases in which they are not involved in the disease process. The authors emphasize that if the radical operation is performed in this manner there is little danger of a relapse, and they prove this in a number of cases.

EDITOR'S ABSTRACT.

THERAPY OF ACUTE RHINITIS BY INTERNAL MEDICATION. F. HUTTER, Monatschr. f. Ohrenh. **70**:1355 (Nov.) 1936.

Hutter reviews studies on the common cold reported by H. S. Diehl (Medicinal Treatment of Common Cold, *J. A. M. A.* **101**:2042 [Dec. 23] 1933) and points out that Diehl, in studying the efficacy of the various medicaments on a large number of patients with acute coryza, found that a combination of codeine and papaverine is to be recommended for general use. Hutter further states that his own investigations on this problem largely corroborate Diehl's observations on the favorable effects of codeine and papaverine. EDITOR'S ABSTRACT.

Miscellaneous

HOUSE DUST HYPERSENSITIVITY IN PERENNIAL ASTHMA OF CHILDHOOD. HENRY N. PRATT, J. Allergy **8**:60 (Nov.) 1936.

The author's summary is as follows:

"By means of intracutaneous tests and passive transfers it has been determined that approximately 79 per cent of children between the ages of one and twelve years who suffer from perennial asthma are skin sensitive to house dust extract and have reagins to this atopen in their serums. The frequency and severity of this sensitivity as evidenced by the magnitude of the skin test and passive transfer reaction increase with the advancing years of childhood."

HOVER, Cincinnati. [AM. J. DIS. CHILD.]

INFECTIONS OF THE UPPER RESPIRATORY TRACT IN CHILDREN. H. M. JAY, M. J. Australia **2**:774 (Dec. 5) 1936.

Jay observes that infections of the upper part of the respiratory tract in children are more potentially serious than those in adults; some children are hypersusceptible to them and have difficulty in throwing them off; defective nasal breathing and malocclusion of the jaws are predisposing factors; allergic states must not be confused with ordinary "colds"; pneumonia is frequently secondary to infection of the sinuses; an infection of a sinus frequently causes persistent "cold"; the first sign of sinusitis may be orbital swelling; a unilateral nasal discharge should always arouse suspicion of the presence of a foreign body in the nose; the free use of meat and fruit juices in the diet as a supplement to milk and carbohydrates raises the immunity to infection; calcium therapy is a useful adjunct in treatment; menthol is not acceptable to the nasal mucous membrane; nasal douches are liable to carry infection to the middle ear, and autogenous vaccines have a great influence in cleaning up these infections.

GONCE, Madison, Wis. [AM. J. DIS. CHILD.]

TASTE AND SMELL IN THE NEWBORN. F. STIRNIMANN, Rev. franç. de pédiat. **12**:453, 1936.

On the basis of the vasomotor and the motor reflexes, Stirnimann finds that the newborn infant is capable not only of perceiving gustatory stimuli but of distinguishing them. The infant is capable of responding to olfactory stimuli but not as consistently as to gustatory ones. Nasal taste is more developed than smell itself. The latter serves to complete taste. Examinations have shown not only simple reflex responses but more complicated reactions which one must range among psychic manifestations.

LESLIE, Evanston, Ill. [AM. J. DIS. CHILD.]

CLINICAL FORMS OF OSTEOMYELITIS OF THE ROOF OF THE ORBIT. G. WEILL and A. KOUTSEFF, Rev. d'oto-neuro-opht. **14**:629 (Nov.) 1936.

Two cases are reported, both of osteomyelitis of the lesser wing of the sphenoid bone and both of fatal outcome due to meningitis. Osteomyelitis of the lesser wing

of the sphenoid bone is so rare that in 1921 Cange discovered only 1 indisputable case in the literature. Clinically the condition is characterized by acute palpebral edema (not under marked tension), unilateral exophthalmos, integrity of the neighboring accessory sinuses, a normal reaction to puncture of the orbit and early acute aseptic meningitis with its complications (papillary stasis, paralysis of the oculomotor nerve and cerebral abscess). Taken together, these symptoms aid in differentiating the condition from acute inflammatory disease of the orbit, sinusitis or suppurative phlebitis of the cavernous sinus.

DENNIS, San Diego, Calif. [ARCH. NEUROL. & PSYCHIAT.]

MOVEMENTS OF LABIA VOCALIA DURING PHONATION. H. WULLSTEIN, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **142**:119, 1936.

Wullstein studied the movements of the labia vocalia on the excised larynges of calves and of human subjects with a photoelectric cell that recorded not only the light falling through the rima glottidis but that shining through the labia vocalia. He was able to demonstrate that the movements of the labia vocalia are upward as well as sideways and that during the movement there is a considerable shifting in the mass of the labia. He found that at first there is an upward movement of the closed labia, which for the duration of the phonation do not return to their true position of rest (closed and not inflated) but merely assume a zero position. Although closed, they remain vaulted. Whereas the roentgenographic curve of the opening of the rima glottidis indicates a brief opening phase with a sharp-angled outline, that recorded by the photoelectric cell proves that the movement within the labia vocalia takes place by a shifting of the masses, with a gradual transition of the back swing into the forward swing. In this movement the first point of contact between the labia during the back swing seems to be within the fasciculus of elastic fibers on the under surface, which in the course of the vaulting and shifting of masses moves farthest toward the medial line. The type of the curve of movement is the same for the larynx of a calf and of a human being (that is, in the larynx without and that with Morgagni's ventricle), but the ratios of the duration of the opening and the closing phase differ. In calves the ratio is 1 to 4 and in human beings 1 to 1. Moreover, in the human larynx loud and vigorous sounds can be produced by comparatively small pressures and quantities of air and the organ is more sensitive to augmentations in pressure. In its natural mode of action it is more sparing with the use of air and pressure and thus is better suited for prolonged use than is that of the calf. Even when the labia vocalia are not closed before air is blown against them they are often capable of producing sounds. At the onset of phonation in such circumstances there is first an approximation of the labia (caused by suction or by pressure from above). During phonation the larynx often completely closes. It may be assumed that a similar action is exerted on well closed labia vocalia.

EDITOR'S ABSTRACT.

DIRECT SIGNS OF TUMOR OF THE BRAIN IN ORDINARY ROENTGENOGRAMS OF THE SKULL. H. HELLNER, Beitr. z. klin. Chir. **164**:583 (Dec. 23) 1936.

Diagnosis of tumor of the brain must answer three questions: the location, the size and the nature of the tumor. According to Hellner, the usual roentgenogram of the skull is capable of contributing important information on these subjects. Knowledge of the alterations caused by a tumor and visualized in an ordinary roentgenogram of the skull, while not as important as the results of neurologic examination and the knowledge of the course of an individual tumor, is nevertheless of considerable value. The author cites Kornblum, who observed calcification in 6.5 per cent of 446 cases of tumor of the brain in which the diagnosis was confirmed by operation or at necropsy. The types of intracranial tumor exhibiting bone formation were, in the author's experience, principally parasagittal meningioma, neurinoma and cholesteatoma. Here the roentgenogram furnishes informa-

tion as to the localization, the size and, to some extent, the nature of the tumor. The author describes localized hyperostoses of the vault and the base of the skull. These were likewise observed principally in cases of meningioma, and occasionally of benign glioma and acoustic neurinoma. The roentgenogram furnishes information as to both the localization and the nature of meningioma. Histologic studies of meningioma characterized by a tendency to hyperostosis demonstrated invasion of bone by tumor cells. The roentgenologic and clinical differentiation of osteoma and meningioma no longer offers serious difficulty. One must be careful in interpreting erosion and atrophy of the skull, which can be caused by general increased pressure in the brain, as well as by the direct pressure of a tumor. They do not furnish any definite evidence of a topographic, qualitative or quantitative kind. The value of roentgenologic signs in the diagnosis of the nature of a tumor of the cerebellopontile angle is limited. On the other hand, the topographic diagnosis of tumor of the acoustic nerve is, as a rule, reliable. The size of the tumor cannot be told from a roentgenogram.

EDITOR'S ABSTRACT. [J. A. M. A.]

CORNEAL LESIONS AFTER REMOVAL OF THE GASSERIAN GANGLION FOR TRIGEMINAL NEURALGIA. C. DRUTTER, Deutsche Ztschr. f. Chir. **248**:55 (Dec. 9) 1936.

Drutter reports that among 69 patients treated for trigeminal neuritis by the injection of alcohol into the gasserian ganglion, keratitis developed in 17 (24.6 per cent). In 9 (52.9 per cent) the lesion became permanent. Eighteen patients were subjected to twenty-seven operations for removal of the gasserian ganglion. The cornea remained normal in all cases. Drutter concludes that neoparalytic keratitis develops only as a result of anesthesia of the cornea. The cause of keratitis remains unexplained in spite of many studies. Primary trigeminal neuralgia seldom involves the first branch of the nerve. Pain in the area of this branch is considered secondary by many authors. The incidence of corneal anesthesia and consequent disease of the cornea cannot be diminished through the practice of injecting alcohol into the gasserian ganglion developed in Germany. Subtotal section of the posterior ganglion section of the root of the trigeminal nerve, according to the method of Frazier and Spiller, does not lead to loss of sensitiveness of the cornea and to neuroparalytic keratitis. The persistence in Germany of a high mortality following operative intervention is due to lack of experience. Injection of alcohol makes the operative intervention even more difficult. Subtotal section is followed by a smaller percentage of recurrences than is injection of alcohol. According to American authors, subtotal resection of the posterior ganglion is the method of choice in the treatment of trigeminal neuralgia. Drutter suggests that the practice of injection should be reserved for patients whose general condition does not justify a major operative procedure. Younger patients should be treated, as far as possible, by operative intervention, to avoid the possibility of keratitis.

EDITOR'S ABSTRACT. [J. A. M. A.]

UNILATERAL EXOPHTHALMOS IN NEUROLOGIC CONDITIONS. JACQUES LEY, J. belge de neurol. et de psychiat. **36**:669 (Nov.) 1936.

Ley discusses the diagnostic value of unilateral exophthalmos when local causes, such as ocular or otologic conditions, and general causes, such as exophthalmic goiter, Recklinghausen's disease, Schüller-Christian disease, Hodgkin's disease, leukemia, acromegaly and infantile scurvy, have been eliminated. In the majority of cases unilateral exophthalmos due to neurologic conditions is secondary to tumor of the brain. Other causes are thrombosis of the cavernous sinus or the jugular vein, the syndrome of the cervical portion of the sympathetic trunk, cerebral and epidural abscess, aneurysms of the cerebral arteries, certain congenital malformations, cranial trauma, meningeal hemorrhage, subdural hematoma, meningitis, oxycephaly, internal hydrocephalus and disease of the sphenoid fissure.

Finally, in rare cases transitory exophthalmos develops after epileptic crises or in association with abnormalities of posture; these conditions, in spite of their rarity, are difficult to interpret.

Unilateral exophthalmos is sufficiently marked to be of diagnostic importance in from 1.5 to 2 per cent of all cases of cerebral tumor. Exophthalmos, unilateral and bilateral, is seen in from 8 to 10 per cent of cases of tumor of the brain. Unilateral exophthalmos may occur in association with intracranial tumor of any location but most frequently with tumor of the base of the brain or of the frontal lobe. A tumor just posterior to the orbit or in the region of the sphenoid fissure often produces exophthalmos. The condition is not as frequent in association with tumor of the temporal lobe, but it may occur, either with or without invasion of the orbital cavity by the neoplastic mass. Exophthalmos is more rare in connection with lesions of the parietal or the occipital lobe or of the cerebellum or the brain stem. In most cases the exophthalmos is on the side of the lesion; contralateral exophthalmos is seen occasionally in cases of tumor of the cerebellopontile angle.

Exophthalmos is most frequent in association with meningiomas and cranial hyperostoses, especially with meningioma of the sphenoid ridge or osteoma of the orbitoethmoid region. Venous or arteriovenous angioma is frequently accompanied with exophthalmos. Gliomas rarely cause unilateral exophthalmos, except those of the optic chiasm or the optic nerves. Unilateral exophthalmos is occasionally seen in association with neoplasms of the region of the hypophysis or of the third ventricle.

The cause of the exophthalmos in cases of intracranial neoplasm is usually direct pressure on the globe by the neoplastic tissue or proliferated bone. Other factors include venous stasis, usually secondary to pressure on the cavernous sinus or the ophthalmic vein, irritation of the sympathetic nerves and paralysis of the extraocular muscles.

WAGGONER, Ann Arbor, Mich. [ARCH. NEUROL. & PSYCHIAT.]

THERAPY OF CHRONIC SUPPURATIONS OF FRONTAL SINUS. W. KRAINZ, Monatschr. f. Ohrenh. **70**:1066 (Sept.) 1936.

Krainz maintains that suppuration of the frontal sinus is almost never restricted to that sinus but involves also the ethmoid and frequently even the sphenoid sinus. For this reason he discusses the treatment of chronic inflammation of the upper nasal sinuses. He says that at the clinic in Innsbruck, Austria, the endonasal operation of Halle is employed for this condition. However, the author does not begin, like Halle, by cutting around the sphenoid; after forming Halle's flap, he removes the ridge of the nose and exposes and enlarges the entrance to the frontal sinus. After describing the rest of the operation, he discusses the results, pointing out that in about 80 per cent of the cases the endonasal operation effected cure. In the remaining 20 per cent of the cases he counteracted the irritation of the sinal mucous membrane by inducing prolonged anemia, and he points out that Herzog employed this treatment in cases of rhinogenic retrobulbar neuritis. The author induces the anemia by inserting into the nose daily for three hours strips of gauze that have been saturated with a mixture of a 0.1 per cent solution of epinephrine and a 5 per cent solution of ephetonin. This treatment is continued until the swelling and the secretions of the mucous membrane disappear, which is usually after from one to two weeks. This conservative measure spares the patient another surgical intervention. Moreover, in the case of some sinal disturbances, even the chiefly polypous forms, the anemia counteracts the changes without surgical intervention.

EDITOR'S ABSTRACT.

NOSEBLEED IN INFECTIOUS DISEASES, PARTICULARLY IN TUBERCULOSIS. B. FREYSTADTL, Monatschr. f. Ohrenh. **70**:1071 (Sept.) 1936.

In the laryngorhinologic examination of patients with pulmonary tuberculosis, Freystadtl observed frequently smaller or larger crusts of blood in the nose. In

answer to the question whether nosebleed is frequent, the patients usually reply that profuse nosebleed does not occur but that they frequently find streaks of blood in their nasal secretion. The author found signs of nasal hemorrhage associated with mild as well as with severe pulmonary tuberculosis, the incidence being approximately 30 per cent. For measles, scarlet fever, sepsis and typhoid the incidence of nasal hemorrhages was not quite as high as it was for pulmonary tuberculosis. In discussing the cause of the nasal hemorrhages associated with infectious diseases, the author analyzes various possible factors, such as changes in the vascular wall, perfusion of nasal blood, the number of thrombocytes, the bleeding time, the coagulation time and the sedimentation speed, but he found no abnormalities which would explain the nasal hemorrhages.

EDITOR'S ABSTRACT.

CRYOTHERAPY IN TUBERCULOSIS OF MUCOUS MEMBRANE. H. ESCHWEILER, Ztschr. f. Hals-, Nasen- u. Ohrenh. **41**:129, 1936.

Eschweiler says that cryotherapy of the mucous membrane of the upper part of the respiratory tract, which was first recommended by B. and F. Teebrügge and by Nussbaum, has been employed at the clinic in Leipzig, Germany. For cryotherapy of the larynx, an improved form of F. Teebrügge's laryngocryocautery was used. More than one year's experience with this method revealed to the author that cryotherapy gives the best prospects of success in cases in which the lesions on the oral and the pharyngeal mucosa are not too extensive. In these cases it is possible to obtain cicatrization without impairing the function of the movable parts (velum palatinum). In cases of isolated ulceration of the epiglottis, cryotherapy likewise promises favorable results. Moreover, freezing is helpful in combating the pain in edematous or ulcerous tuberculosis of the epiglottis, although cicatrization cannot be expected in these cases, because the arytenoid region and the aryepiglottic folds are usually involved. Cryotherapy is not advisable in cases of perichondritis of the arytenoid cartilage and of closed infiltrates on the posterior wall of the larynx.

EDITOR'S ABSTRACT.

TREATMENT OF PULMONARY SUPPURATIONS WITH HYPERTONIC SALT SOLUTION. R. S. BERKMAN and V. M. DOKSHIZKAYA, Vrach. delo **19**:1069 (Dec.) 1936.

Twelve patients with pulmonary suppuration were treated with intravenous injections of hypertonic saline solution. About nineteen injections were given to each patient. In each of 9 patients roentgen examination showed a large cavity (12 cm. in diameter in 1 case). Under the treatment mentioned, each patient's temperature became normal, and the sputum and odor, as well as the cavity, disappeared. Each patient gained from 4 to 19 Kg. One patient died, but the others have maintained their working capacity up to date. No exacerbation of the process was noticed in any.

The authors believe that their observations allow them to recommend intravenous injections of saline solution for pulmonary suppuration. They likewise point out that this method has the advantage of being safe and practicable under any condition.

BODER, Los Angeles. [AM. J. DIS. CHILD.]

Society Transactions

COLLEGE OF PHYSICIANS OF PHILADELPHIA, SECTION ON OTOLARYNGOLOGY

DR. CURTIS C. EVES, *Chairman*

Oct. 20, 1937

DR. WILLIAM HEWSON, *Clerk*

DR. GEORGE L. WHELAN, *Recorder*

VINCENT'S INFECTION OF THE MOUTH, THROAT AND LARYNX: REPORT OF A CASE. DR. A. J. WAGERS.

In an unusual case of Vincent's infection, the local lesions at first resisted all treatment and spread to such an extent that the patient's life was endangered. The patient finally recovered. As this condition is most commonly not serious and responds readily to treatment, a report of the case appears justifiable.

The patient, a young man aged 17, had a slight cold, which was followed by soreness of the throat, the mouth and the gums. After a few days, ulcers appeared on the base and the sides of his tongue, and an abscess developed on his ankle. As local measures failed to bring relief, he became weak, lost about 15 pounds (6.8 Kg.) and had difficulty in talking and swallowing. His tonsils had been removed. In 1932 he had been in the hospital for about six weeks because of anemia, loss of weight, jaundice and weakness. When I saw the patient he was pale and sallow, but there was no jaundice. Examination revealed about ten small and one large ulcer on the tongue and a fairly large ulcer on the posterior wall of the oropharynx. No membrane was visible. There was a slight tender swelling in the right submaxillary gland. As the blood count showed no leukopenia, agranulocytic angina was not suspected.

Cultures of material from the ulcers on the tongue yielded Streptococcus haemolyticus, and culture of material from the ulcer on the ankle, Str. haemolyticus and Streptococcus aureus. Smears from the lingual ulcers revealed Vincent's organism. The infection was therefore taken to be a mixed type, caused by Vincent's organism and streptococci. A slight improvement followed the use of an antiseptic mouth wash and local administration of neoarsphenamine in glycerin. Peruvian balsam was applied to the ankle. Ten days after admission, liver therapy was begun. Silver nitrate was applied to the lingual ulcers, but they did not improve. The patient's voice became weaker and finally hoarse. His temperature remained between 100 and 102 F., and the condition of the blood was about the same. He gradually became worse, the lingual lesions enlarging. A herpetic eruption appeared on the scalp. Finally he was given a blood transfusion. However, complete aphonia soon developed. An ulcer covered with a blackish exudate appeared on the right side of the hypopharynx. The general appearance of the throat suggested agranulocytic angina, but the white blood cell count was still 9,600. The neck became infiltrated and sensitive to pressure. Slight improvement followed intravenous administration of neoarsphenamine and repeated blood transfusion. The patient coughed frequently, and there was abundant expectorate, but no Vincent's organisms or acid-fast bacilli could be demonstrated in the sputum. He began to improve and was soon eating and sitting up, and the lesions were subsiding. Between the fourth and the fifth week after admission, however, in spite of the general improvement, marked leukopenia (1,900 leukocytes) was noted. He was given 10 cc. of pentnucleotide, and the blood transfusions were continued.

Finally his voice returned, and slowly the lesions on his tongue and his ankle cleared. A roentgenogram of the chest suggested early bronchiectasis. A new crop of ulcers of more superficial type appeared on his tongue but soon responded to 10 per cent mild protein silver. In all, it had taken five months to get rid of the infection of the mouth and the throat, and the leukopenia developd long after the general and local condition had improved. The case illustrates the value of the intravenous administration of neoarsphenamine in the treatment of Vincent's infection, the supportive value of blood transfusions and the favorable response of leukopenia to pentnucleotide.

NEW METHOD OF OPERATION FOR CONGENITAL ATRESIA OF THE POSTERIOR NARES. DR. JOSEPH C. DONNELLY.

This paper appears in full in this issue of the ARCHIVES, page 112.

REPORT OF A CASE OF OTITIC MENINGITIS. DR. D. N. HUSIK.

Aside from a few recent cases, recovery from streptococcic meningitis has been almost unheard of.

A boy aged 5½ years was admitted after suffering pain in his left ear for forty-eight hours. He had suffered from running ears after an attack of measles and pneumonia at the age of two years and had been asthmatic since his third year. The diagnosis at the time of admission was infection of the upper part of the respiratory tract, with otitis media on the left. Consultation four days later revealed bilateral otitis media, and bilateral incision yielded pus. A zygomatic swelling developing within the next few days was attributed to zygomatic perforation, and roentgen examination revealed the presence of bilateral acute mastoiditis. Mastoidectomy was performed ten days after admission. Exposure of the dura revealed no pathologic condition. On the first day after operation the child complained of frontal headache. He vomited repeatedly, and his temperature went up to 104 F. On the following day he appeared toxic, dehydrated and acidotic, with nuchal rigidity and bilateral Kernig's sign. A blood count showed 58 per cent hemoglobin and 27,000 leukocytes, with 98 per cent polynuclears. Culture of the spinal fluid, which was cloudy and escaped under pressure, yielded hemolytic streptococci. Cultures of material from the mastoid likewise yielded this organism.

Repeated spinal drainage and transfusion were used, with drainage of the subarachnoid space. As continuous spinal drainage on a Bradford frame proved difficult, the drainage was repeated at intervals of eight hours. The child was given continuous venoclysis with 5 per cent dextrose solution and 5 cc. of a derivative of sulfanilamide known as prontosil soluble (the disodium salt of 4-sulfamidophenyl-2′-azo-7′-acetylamino-1′-hydroxynaphthalene-3′,6′-disulfonic acid) intramuscularly and 5 grains (0.32 Gm.) of sulfanilamide by mouth every four hours. Four days after the mastoidectomy the mastoid was reopened and the dura explored. Two long incisions were made for drainage. Mercurochrome was given intravenously, but in spite of all efforts the child died. Autopsy revealed an organized exudate over the base of the brain, with small collections of pus in the cerebral sinuses and dilatation of the ventricles. The bone roof of the sphenoid sinus was softer than normal and may have been the cause of meningitis, although this was not suspected as the respiratory symptoms subsided. The entrance of the organisms into the meninges was probably through the venous system.

SPONTANEOUS RADICAL MASTOIDECTOMY. DR. C. E. TOWSON.

Spontaneous radical mastoidectomy is extremely rare. I was unable to find a case in the available literature. In 2 cases partial spontaneous mastoidectomy has been described, in 1 following erosion by a cholesteatoma to form a fistula into the canal, and in the other in association with chronic mastoiditis, cholesteatoma and fistula into the external auditory canal. In the case presented here the result accomplished by nature was like that usually accomplished only by a thor-

ough radical operation, with complete removal of the tympanic membrane and ring; the posterior canal wall was entirely removed down to the level of the external semicircular canal, and the tympanum, the antrum and the mastoid were converted into one cavity, seen through the meatus of the canal.

The patient, a man of 54 years, had suffered for eight years from chronic purulent otitis media on the right, with pain, total deafness on that side and vertigo. The left ear was unaffected. In 1926 he fell and bumped his head, and there were bleeding from the right ear and a discharge that lasted for a week. In 1935 he received a blow on the head; this was followed by discharge from the ear but no pain. He was given some drops of boric acid and alcohol to instil into his ear.

Examination on Jan. 1, 1937, revealed inspissated foul pus and desquamated epithelium. When this was cleaned out, a small amount of granulation tissue was exposed in the tympanum. Audiometric tests revealed 73 per cent loss of hearing for speech on the right side and 38 per cent on the left. The Wassermann and the Kahn reaction were negative. Roentgen examination revealed a few mastoid cells on the left side, but the majority were destroyed. There was no evidence of mastoid cell structure on the right side. Malignant growth, tuberculosis and syphilis were ruled out. Most probably the phenomenon was due to cholesteatoma, since a small amount of cholesteatomatous material was found at one time in the cavity.

NASAL TEETH: REPORT OF A CASE. DR. W. J. HITSCHLER.

This paper will be published in full in a subsequent issue of the ARCHIVES.

DR. CURTIS C. EVES, *Chairman*

Nov. 19, 1937

DR. WILLIAM HEWSON, *Clerk*

DR. GEORGE L. WHELAN, *Recorder*

DIFFERENTIAL DIAGNOSIS OF BACTERIAL MENINGITIS OF AURAL AND OF NASAL ORIGIN. DR. JOSEPH C. YASKIN.

This paper was published in full in the April 1938 issue of the ARCHIVES, page 444.

MEDICAL TREATMENT OF OTITIC MENINGITIS. DR. KARL M. HOUSER.

The medical treatment of otitic meningitis up to last year must be considered as a failure except in rare instances of recovery. Recent reviews of the literature have revealed no more than 76 recoveries in the last thirty-five years. Since the report of the first case of otitic meningitis to be cured with a derivative of sulfanilamide known as prontosil tablets (the hydrochloride of 4-sulfamido-2',4'-diaminoazobenzene), in 1936, 106 cases of recovery following the use of this drug or allied preparations have been reported. To date most of these cures have occurred in cases in which the infection was with hemolytic streptococci, but recently it has been claimed that pneumococcic infections will respond to this treatment. Prontosil and sulfanilamide have both been used with a certain amount of success in the treatment of hemolytic streptococcic infections of all types, but the mode of action of these complex chemicals is not fully understood; in the test tube their bactericidal action is slight. Bliss and Long believe their effect to be inhibitory and/or bacteriostatic, retarding the growth of the bacteria and permitting phagocytosis to keep pace with bacterial proliferation. Large doses by various routes prove effective. The drugs have been given by mouth, subcutaneously, intramus-

cularly and intrathecally. From the increasing number of reports of untoward reactions, it is obvious that their use should be carefully supervised and their effects constantly observed.

SURGICAL TREATMENT OF OTITIC MENINGITIS. DR. WALTER ROBERTS.

Advances in the therapy of otitic meningitis have yielded an increasing number of cures, so that prognosis is no longer so hopeless as formerly. Although diffuse purulent leptomeningitis is still inevitably fatal, owing to the complete absence in this form of any tendency toward formation of limiting adhesions, reports of recovery from the circumscribed purulent type of leptomeningitis and from serous meningitis are accumulating. As differential diagnosis between the three types is practically impossible in the early stages of the disease, treatment is instituted promptly in all cases. In fact, the success of treatment depends on its earliest possible application. Immediate spinal puncture is indicated, with removal of only sufficient fluid for examination, as withdrawal of larger amounts may favor spread of the infection. An increased cell count in the spinal fluid indicates immediate operation, a complete simple mastoidectomy in cases of acute disease or a radical operation if the acute attack has been preceded by a chronic otic discharge. After the usual mastoid procedures, the dura of the middle and the posterior fossa should be widely exposed and all diseased bone in contact with the dura removed.

Opinions differ as to the optimum time for incision of the dura. Whereas G. E. Shambaugh Jr. has expressed the belief that dural incision is indicated only after development of generalized meningitis, James Adam and E. A. M. Connal, of Glasgow, Scotland, advocated prompt incision, on the basis of their remarkably successful series of 7 cures in 9 cases. I advise waiting twenty-four hours before incision because, in my experience, within this period sufficient improvement to render incision superfluous sometimes occurs. Two illustrative cases are cited, in both of which the symptoms evidently were due to serous meningitis and in which immediate relief followed eradication of the focus of infection.

In both cases the disease was circumscribed purulent leptomeningitis and the patient a youth of 17 years. In the first case meningitis due to Pneumococcus type III followed a simple mastoidectomy. The focus of infection was destroyed by reopening of the mastoid and removal of the tegmen, the antrum and the tympanum with 1 square inch (6.4 sq. cm.) of the squamous plate; spinal taps, specific antiserotherapy and blood transfusions were employed. The patient was discharged cured on the forty-seventh day. In the second case meningitis due to Bacillus proteus followed removal of polyps. Radical mastoidectomy disclosed polypoid degeneration of the mastoid tip, with erosion into the middle fossa. After removal of the focus of infection, subarachnoid drainage and blood transfusions, the patient was discharged on the twenty-eighth day. In this case spinal taps were employed twice a day for the first two days, and pressure was maintained in the spinal fluid for the next six days by means of the indwelling spinal puncture needle. Bacteria and pus in the spinal fluid do not necessarily imply a diffuse process.

LANTERN SLIDES OF ANATOMIC SPECIMENS. DR. ADDINELL HEWSON.

RHINOGENIC MENINGITIS. DR. GEORGE M. COATES.

Dr. Wells P. Eagleton in a recent communication stated that the surest way to cure meningitis is to prevent it. With this point in view I shall briefly mention certain anatomic pathways through which infection may be a cause of rhinogenic meningitis. The members are all familiar with the so-called butterfly area of the nose. This area bounds the upper lip and passes upward and outward alongside the ala nasi and thence to near the outer canthus. Its configuration resembles that of a butterfly, hence the name. This area is important clinically, for the veins here do not drain into the external jugular vein, but take a different course. The minute radicles empty into the angular, the common facial and the inferior and the

superior ophthalmic vein and finally into the cavernous sinus. Thus, any pyogenic infection in this area might gain ingress to the cavernous sinus and cause meningitis or septicemia. By the time the cavernous sinus has become thrombosed, the overwhelming septicemia usually causes death. Every infection here should be treated with the utmost conservatism, and no furuncles or boils in this area should ever be squeezed. Hot compresses or poultices of boric acid or magnesium sulfate, infra-red radiation and vaccines are the safest agents of treatment. The local infection should be left severely alone unless a white necrotic point is seen, when a sharp knife can be introduced so as to lift the necrotic spot and permit the core to come out. It should be remembered that thrombophlebitis of the cavernous sinus is 100 per cent fatal, even in the best of hands.

Another pathway of infection is by passage up the perineural sheaths of the olfactory filaments through the cribriform plate (Key and Retzius). This pathway is followed in cases in which the protective barriers of the nose have been broken down. Still another factor in the genesis of rhinogenic meningitis is any osteomyelitic process of the nasal accessory sinuses. Trauma, either direct or operative, may be an important cause. When intranasal operation is injudiciously performed meningitis occasionally becomes the final issue.

Eagleton has stated that in far the larger proportion of cases abscess of the brain and meningitis are caused by passage of the infective process by way of infective retrograde thrombophlebitis and not by direct extension of the suppurative process. The venous tributaries of the accessory nasal sinuses are rich; the maxillary, the ethmoid and the sphenoid veins drain down the pharyngeal veins in the neck, whereas the frontal veins drain intracranially, as Zwillinger and others have shown. Indeed, the intimate relation in the supply of blood and of lymph between the frontal sinus, the bone and the dura explains at once how frontal sinusitis could lead to an intracranial involvement. The maxillary sinuses are the least likely to cause meningitis and the ethmoid, the sphenoid and the frontal sinuses most likely.

With these principles in mind, I can say that early and accurate diagnosis, based on a complete history, a careful examination, anatomic, physiologic and pathologic analysis of the problem and the use of such laboratory aids as will shed further light on obscure points, will go far in preventing dangerous intracranial sequelae. Adequate aeration and drainage of all the accessory sinuses should be the first aim. This may require correction of septal deviations, spurs, hypertrophies and hyperplasias, as well as suitable medication to keep the turgescent mucosa occasionally constricted. Lymphoid elements in the fauces and the nasopharynx may have to be removed. It is most important that the sinuses be drained thoroughly and effectively. All radical sinal operations should be gently and carefully carried out. Often a thorough clean-up can go far toward producing recovery if the diagnosis is made early enough. Osteomyelitic processes may call for conservative or operative measures, the latter to remove the infected or devitalized bone for a distance of about 2 inches (5 cm.) beyond the osteomyelitic area. The general trend of opinion today is that this work should be from the clean to the infected area. The conservative method includes every means whereby the economy is brought up to the highest possible state of nutritional efficiency. In all this it is of the utmost importance that there be the closest cooperation between rhinologist, ophthalmologist, neurologist, internist, neuro-otologist, radiologist and neurosurgeon.

The rhinologist works through an infected area, cleans out the original focus of infection in the sinus (or the ear) and then traces the pathway from the first focus of infection to secondary foci that may have been established in the intracranial structures. All foci of infection are drained. During the search an extradural abscess may be discovered. If so, free drainage should be provided at once, or serious consequences may follow.

Therapy for rhinogenic meningitis consists of thorough drainage of the infected sinus and the subarachnoid space. Time will not permit further remarks concerning definite technic, except the statement that after adequate drainage of the sinus has been provided, the subarachnoid space should be drained continuously by lum-

bar or cisternal puncture. All supportive measures, such as blood transfusions, should be used and medication with sulfanilamide orally and with a derivative of sulfanilamide known as prontosil (the disodium salt of 4-sulfamidophenyl-2′-azo-7′-acetylamino-1′-hydroxynaphthalene-3′,6′-disulfonic acid) intramuscularly, which recently seem to have had promising results, used judiciously.

DISCUSSION

DR. HENRY DINTENFASS: I divide cases of otitic meningitis into four groups. In cases of the first group the cerebrospinal fluid contains organisms; the disease is fulminating, resists all treatment and ends in death. In cases of the second group there are no organisms in the cerebrospinal fluid, but, owing to the intense virulence of the organisms, the patients die of the toxins produced. In such cases the organisms give no growth on culture. In cases of the third group the cerebrospinal fluid is likewise free from organisms, but the infection is mild, and with proper treatment the patient recovers. In cases of the fourth group the cerebrospinal fluid contains organisms but of a less virulent type than in the first group, so that recovery is not excluded. I have observed 3 cases of the last group in which recovery was attributed to the procedure outlined by Dr. Roberts, including prompt, thorough mastoidectomy, incision of the dura twenty-four hours later, elevation of the foot of the bed to permit gravity drainage of the cerebrospinal fluid and packing of the wide open mastoid wound. At reoperation forty-eight hours later more bone was removed and another dural incision made anterior to the first. The dural incisions must cut across the sulci between convolutions to insure free drainage and must not be too long or too close together. One of the pathways of infections in cases of otitic meningitis is through the middle fossa near the petrous tip. The policy of leaving the operative field wide open applies principally in cases of otitic meningitis. In cases of meningitis of nasal origin adequate drainage is often anatomically impossible. The essential treatment in cases of otitic meningitis is to remove the focus of infection in the mastoid or the temporal bone in contact with the dura. I have not had success with the Kubie treatment of meningitis, and I feel that the danger of edema of the base of the brain outweighs any advantages it may have to offer. It seems logical to assume that institution of drainage near the site of origin of the infection would be of greater advantage than lumbar puncture, which so often leads to spread of infection, owing to release of pressure. Regardless of the type of causative organism, sulfanilamide or a similar preparation should be tried in conjunction with other methods of treatment.

DR. CURTIS C. EVES, *Chairman*

Dec. 15, 1937

DR. WILLIAM HEWSON, *Clerk*

DR. GEORGE L. WHELAN, *Recorder*

THE NEW LOCAL ANESTHETICS IN OTOLARYNGOLOGIC PRACTICE. DR. M. VALENTINE MILLER.

Used alone, the new synthetic local anesthetics give results less satisfactory than cocaine, even though they are considered safer. When they are combined with epinephrine, the danger of intoxication is diminished and the duration of anesthesia increased, because epinephrine retards absorption. The toxic effect of the synthetic drugs is dependent on the rate of absorption rather than on the quantity of the drug administered. It must be kept in mind that, whereas cocaine is a cerebral stimulant and overstimulates the respiratory centers, the synthetic preparations, with the exception of tutocain, are depressants. The symptoms of intoxication by the latter include pallor, sweats, a tendency to fainting, nausea

and vomiting, associated with a weak pulse and shallow respiration, which occur as a rule when the head is lowered. In cases of extremely severe disease paralysis of the respiratory tract or cardiac failure due to direct action of the drug on the cardiac muscle may ensue. As a rule, artificial respiration and circulatory maintenance will lead to recovery. Circulatory stimulants accelerate the passage of the blood containing the drug to the liver, where detoxication occurs. Massage of the heart, or even injection of epinephrine into the heart, may be of aid. In the presence of air hunger, the inhalation of oxygen is indicated, and intravenous injection of coramine (a 25 per cent solution of pyridine betacarbonic acid diethylamine) may be used to stimulate respiration and circulation. Owing to the fact that these synthetic anesthetics are already depressant, the administration of derivatives of morphine and of barbituric acid is contraindicated. The number of fatalities due to synthetic local anesthetics is low, but it must be kept in mind that some of these deaths may be attributable to idiosyncrasy.

In susceptible subjects epinephrine may cause palpitation, vomiting, excitement, tremor and anxiety, and in cases in which the involvement is severe, diarrhea, hematuria, ascending paralysis, fall in temperature, convulsions and death. In cases of serious cardiac disease as little as 0.4 cc. of a 1:1,000 solution of epinephrine hydrochloride may prove dangerous. This drug is of special danger in the presence of hyperthyroidism. To exclude hypersensitivity, a preliminary test injection of from 0.2 to 0.3 cc. should be given.

To prevent toxic manifestations, these synthetic local anesthetics should not be given to patients with pulmonary or cardiac disease except in carefully selected cases, and then only in combination with proper supportive treatment to combat their depressant action. Test injections of the solutions or conjunctival tests should be made to exclude hypersensitivity. Cutaneous tests are unreliable for this purpose. Hypersensitivity to epinephrine must be ruled out but is fortunately rare. The injections should be given with the patient in the reclining or the semireclining position, and preliminary administration of sedatives is contraindicated. Before the fluid is injected, the plunger of the syringe should be withdrawn, to make sure that a vein has not been entered.

These anesthetics may be applied by injection or topically. By injection the epinephrine may be given first or together with the anesthetic. I prefer to give the epinephrine first. Among the more slowly soluble anesthetics for topical application, are ethyl aminobenzoate, orthoform, butesin and butesin picrate. Among soluble anesthetics are procaine hydrochloride, pontocaine, nupercaine, tutocain, larocaine hydrochloride, metycaine, alypin, butyn, apothesine and benzyl alcohol. Some of the less well known ones include diothane hydrochloride, phenacaine hydrochloride and procaine borate.

I have had personal experience with pontocaine, larocaine hydrochloride, nupercaine and butyn. For the past two years I have used pontocaine almost exclusively for topical application and procaine hydrochloride for injection.

Dr. Curtis C. Eves, *Chairman*

Jan. 19, 1938

Dr. William Hewson, *Clerk*

Dr. George L. Whelan, *Recorder*

Large Protruding or Prolapsed Ears: Anatomic Considerations and Surgical Correction. Dr. Warren B. Davis.

Large protruding or prolapsed ears are congenital deformities in which the dominating abnormality is a deficiency or even an absence of the antihelicine fold. The type of cap worn has no etiologic or therapeutic significance except as a

postoperative measure. Embryologically, the auricle arises from six elevations, variations in the development and fusion of which determine the primary contour of the ear. The normal range of aural contour is fairly wide, and the size and the shape of the ear, whether normal or pathologic, may be inherited. In a few cases abnormally prominent ears are of normal shape but have an abnormal attachment to the head, but in by far the majority of cases there is abnormality of the ear itself.

Plastic surgery is indicated in cases in which the deformity is sufficient to be a detriment in the search for employment or to affect the psyche of the patient. Monks' operation is applicable only to slight deformities. The best operations of today are founded on the basic principle emphasized by Luckett that an antihelicine fold must be established to secure a satisfactory cosmetic result. With near normal contour restored and a 30 degree cephaloauricular angle established, the ear ceases to be conspicuous, even if a little larger than normal. I do not consider through and through excisions of skin and cartilage indicated for reduction of size only. Dressings should be applied to hold the ear in overcorrection for a few days. Bandages are used for two weeks to aid the union of the cartilaginous margins, and a light elastic cap is worn at night for a month or six weeks.

Results were most gratifying in all cases in which the Luckett operation or a modification was used, not only because of the cosmetic effect but because of the marked change in mental attitude and psychologic outlook of the patient.

PRIMARY MELANOMA OF THE NASAL CAVITY: TWO CASES. DR. AUSTIN SMITH.

By reporting 2 cases of melanoma of the nasal cavity, I am bringing the number reported in the English literature up to 14.

CASE 1.—A white woman of 60 years was admitted for recurring epistaxis from the left nasal chamber. Examination revealed a small soft red wartlike growth springing from the floor of the left nasal chamber just beyond the vestibule; this was removed with a snare and its point of attachment cauterized. Histologic examination revealed a melanoma of apparently but not definitely malignant type. Sixteen months later removal of a nodule in the submaxillary region was followed by postoperative roentgen treatment because of histologically suspected malignant growth. No pigment cells were noted. Two years later tinnitus and deafness in the left ear developed, and two weeks later double vision and disturbance of balance followed. The patient's condition was diagnosed as intracranial metastasis in the left cerebellopontine angle from malignant tumor in the submaxillary region. She became rapidly worse and died in coma within six weeks. Slides from the nasal tumor and from the submaxillary tumor were found to be histologically identical except for the absence of pigment in the latter. Death was undoubtedly due to intracranial metastasis from the primary nasal growth.

CASE 2.—A man aged 35 years complained of obstruction of the right side of the nose of four months' duration. Polyps had been removed from this region because of obstruction three years before. Examination revealed a granular growth involving the anterior tip of the right inferior turbinate, attached by a pedicle with rather a broad base. This was removed with a snare under local anesthesia. Histologically it was considered to be a form of granuloma. Biopsy following local recurrence sixteen months later revealed carcinoma; radical operation was advised but refused. Ten months later a nodule appeared at the angle of the jaw. After ligation of the right external carotid above the superior thyroid artery and removal of the submaxillary node, a Rouge or Denker operation was performed on the right side. The growth had extended by continuity to the nasoantral wall and the ethmoid area without extensive involvement of the sinuses. Histologically the cells of the submaxillary node were similar to those of the primary growth

but showed definite pigmentation. The diagnosis was melanoma. A few months later an acute abdominal condition developed, which proved to be intestinal obstruction due to thrombosis of the mesenteric vessels by tumor cell emboli. The cells were identical with those of the previous slides and showed scattered pigment. When last heard from, the patient was declining rapidly, with generalized metastasis. Roentgen therapy had no effect.

There are various theories of the origin of these tumors. Ordinarily, malignant melanoma is thought to have its origin in a nevus of the cutaneous surface, but it may develop from misplaced tissue or cell rests in the mucous membranes. The presence of pigment confirms the diagnosis, but its absence does not exclude melanoma. Considering the slow growth of the primary lesion and the extremely rapid dissemination of the metastases, I believe it probable that complete removal of the tumor with a wide margin of normal tissue would offer an excellent chance of cure. In cases of tumor of the anterior part of the nasal cavity, lateral rhinotomy or the Rouge or Denker operation may be indicated. In handling malignant tumors of this region, a physician must make careful histologic study of the tumor before a proper plan of treatment can be formulated.

PARENTERAL ADMINISTRATION OF CERTAIN SUBSTANCES IN TREATMENT OF INFECTIONS OF THE UPPER PART OF THE RESPIRATORY TRACT. DR. GEORGE M. COATES, DR. WARREN B. DAVIS and DR. WILLIAM GORDON.

Manifold etiologic factors must be looked for and considered by the laryngologist in the motley group of cases of nasal dysfunction encountered in daily practice. Much of the recent progress in laryngologic practice is attributed to a more thorough realization of the influence of systemic disturbances on laryngologic conditions and vice versa. In the treatment of these conditions much importance is attached to personal hygiene and correct diet. The employment of suitable stock vaccines, of doses of 3 units of insulin and of compound solution of iodine in doses of 3 drops, nonspecific protein therapy and similar measures are added for the purpose of stimulating defensive mechanisms and metabolism. In some cases cooperation of the internist is invited in the hope of improving results.

In some cases in which there are fair to good intranasal mechanics the most refractory conditions with mucosal intumescence and excessive postnasal secretion respond to oral administration of calcium, strychnine sulfate, thyroid, atropine sulfate, dilute hydrochloric acid, sodium bicarbonate, sodium chloride, phenobarbital, ephedrine sulfate and similar agents.

For a long time we have been under the impression that parenteral administration of various substances might be of aid in treating the more refractory conditions. Among the substances considered for this purpose were camphor, menthol, iodoform and iodides in an oil vehicle. The effects of these drugs on respiration, circulation and metabolism were reviewed. Parenteral administration of these substances has given good results in the treatment of hay fever, asthma and sinal infection. In the cases here under discussion, a combination of the drugs mentioned seemed desirable, in order that their full value might be realized. Finally a standardized commercial product consisting of 2 per cent camphor, 4 per cent menthol, 1 per cent iodoform and 0.1 per cent antimony in peanut oil was selected for the purpose. It is supplied in sterile ampules in accurately measured doses. In the majority of cases the injections were given intramuscularly, but from recent experiments it appears likely that subcutaneous administration will prove just as efficacious. The injections were made at varying intervals according to individual indications. In cases of acute involvement there was improvement after one or two injections, while chronic disease resisted longer. Although the series studied comprised various types of acute, subacute and chronic sinal involvement, including some of allergic and of vasomotor origin, and this paper is offered not as a scientific contribution but as a preliminary report, the results indicate that the method merits further trial, at least as an adjunct to approved and tested procedures. It offers no substitute for surgical methods but

may well contribute to their success. Best results were obtained in the treatment of acute disease and of acute exacerbations of low grade chronic sinusitis, though in some cases chronic disease associated with minor endocrine imbalance responded nicely. The intervals between injections in cases of acute disease were of three or four days and in cases of more chronic disease of one or two weeks. Gratifying results were obtained in 32 per cent of the cases, beneficial results in 30 per cent, uncertain findings in 36 per cent and unsatisfactory results in 2 per cent. The series included 284 cases in which the disease had previously resisted other routine treatment.

DISCUSSION

Dr. George M. Coates: We have had a certain number of favorable results. The injection of this preparation is practically painless, and only 1 patient told me that the pain was most severe. However, this patient always complained about everything. When I wiped his nasal fossa with some weak shrinking solution, he complained bitterly to me that this was most painful. This preparation merits further use, and it is not unlikely that some more favorable results will be observed. It is my impression that in some cases of sinal disease associated with endocrine imbalance there has been improvement. I want to ask the chairman if he would be kind enough to call on Mr. Lichtin, who has given us much help in chemical matters and in materia medica.

Aaron Lichtin, Ph.G.: The preparation is a harmonious one. The peanut oil has a low acid curve, is highly bland and is apt to be in a purer state than other oil vehicles. Peanut oil is widely used as an oil vehicle. The antimony iodide is a stabilizer to hold the camphor and the iodoform.

Dr. William Gordon: It is necessary to reiterate that the cases of acute disease and of acute exacerbation of chronic disease used in this study, in which we had gratifying results, were those in which the condition was refractory. It is possible that a patient with acute disease would get well anyway, but our group generally comprised patients who were slow in getting well. We wanted to hasten the recovery generally, which was our reason for adding the use of this parenteral preparation to our routine. Patients presenting hyperplastic changes did not, in our series, benefit from this preparation. We felt that hyperplasia represented further progress in the histologic picture—an irreversible change, so to speak—and was not amenable to local conservative treatment, even with catalytic adjuvants.

Dr. Donnelly brought up an interesting point with reference to iodine sensitivity. When such a manifestation is encountered and an injection causes allergic manifestations, no further injection should be given. The subject should be tested by the allergist (as indeed all allergic subjects should) and other agents suitable to him utilized. Any allergic subject who is not sensitive to the medicaments in this preparation may receive the therapy advocated. It should be remembered, however, that the drug is not a cure-all but merely an adjuvant to tested agents.

Early Attention to the Larynx in Tuberculous Patients. Dr. Robert M. Lukens.

Except in sanatoriums and clinics for patients with tuberculosis, in which examination of the nose and the throat is a routine procedure in all cases of pulmonary tuberculosis, invasion of the larynx by tuberculosis is usually well under way before it is recognized, and treatment is rarely begun until long after the onset of this complication. As successful treatment of laryngeal tuberculosis depends largely on its early application, early diagnosis is of the utmost importance. I believe that prior to the lodging of the tubercle bacillus in the submucosa there has been a denudation of epithelium due to inflammation. The regeneration of epithelium over the implanted organism results in a histologic tubercle. Proper treatment at this time may heal the tubercle. If the larynx is not in good condition, the tubercle may develop, with eventual caseation and ulceration. Pyogenic invasion of this ulceration leads to further extension of the lesion. Both tubercu-

lous and pyogenic ulcers may be present. The tuberculous lesions may spread to the deeper structures, with resulting chondritis and perichondritis, often leading to complete destruction of the epiglottis and the arytenoid cartilages.

In the early stages of tuberculosis of the larynx there are few symptoms except slight cough due to irritation and the gradual onset of hoarseness. By the time dysphagia and constant hoarseness have developed there is little hope of cure or relief. Epiglottic lesions and lesions of the arytenoid cartilages with pseudoedema cause dysphagia. The probability of cure diminishes as the disease progresses. A progressing laryngeal lesion has an unfavorable effect on existing pulmonary lesions, and diminished resistance to the laryngeal process results, thus forming a vicious circle. An improving pulmonary lesion is no indication that the larynx is free from disease or that existing laryngeal disease is improving. Early and periodic laryngeal examination is therefore indicated from the beginning of pulmonary disease.

The mortality rate of pulmonary tuberculosis is gradually decreasing, owing to efforts to conquer the disease in its earliest stages, and a similar program would have a similar effect on the statistics of laryngeal tuberculosis. All patients with pulmonary tuberculosis should be under the care of both an internist and a laryngologist from the beginning of the disease. Infections of the respiratory tract should be cleared up. If proper attention is paid to the nontuberculous infections of the upper part of the respiratory tract, there is no doubt that active tuberculous laryngitis could be prevented in many cases. Vocal rest is of value in prophylaxis of laryngeal inflammations, and education of the patient with regard to his larynx before laryngeal lesions appear is of great value.

DISCUSSION

DR. GEORGE M. COATES: I recommend laryngeal examination at frequent intervals as a routine in cases in which the condition of the chest is suspicious. I should be pleased to know if Dr. Lukens is continuing the use of chaulmoogra oil and if he is pleased with his results. Does he observe many cases in which amputation of the epiglottis would be beneficial?

DR. GEORGE L. WHELAN: I recommend laryngeal examination in all cases of pulmonary lesions. If the larynx appears suspicious examinations should be conducted more frequently. I have used Dr. Lukens' concentrated oil, modifying it by adding 1 grain (0.06 Gm.) of menthol and 2 grains (0.13 Gm.) of cocaine alkaloid to an ounce (29.6 cc.) of the oil. This, I believe, renders the oil more palatable to the patient and helps relieve the dysphagia. I try to have the patient expectorate the excess, as it is possibly irritating to the stomach and the taste is not too pleasant. It is possible that some patients who have not been helped by chaulmoogra oil have had it instilled into the esophagus. In some of the cases at the Eagleville Sanatorium for Consumptives, Eagleville, Pa., I have done a tracheotomy, which places the larynx at rest, have given Lukens' oil and, if necessary, have made injections into one or both the superior laryngeal nerves. Anything which may give relief to the patient should be tried.

DR. ROBERT M. LUKENS: In answer to Dr. Coates's question regarding chaulmoogra oil, I wish to say that I still like it. Unquestionably, as Dr. Whelan states, it is irritating to the stomach; I ask the patients to expectorate the overflow. Recently I have not amputated the epiglottis. Occasionally I touch the edematous area on the epiglottis or the arytenoid cartilage with the cautery, using only one or two applications during each treatment. I have done a tracheotomy on only 1 patient with laryngeal tuberculosis. The larynx became well, but the patient later died. I prefer local applications and vocal rest. In answer to Dr. Donnelly's question: I inject a 60 per cent solution of alcohol in 1 per cent procaine hydrochloride into one or both superior laryngeal nerves and repeat the procedure when dysphagia returns.

DEMONSTRATION OF SECTIONED SKULL, TO SHOW RELATIONS TO ACCESSORY NASAL SINUSES. DR. ADDINELL HEWSON.

DR. CURTIS C. EVES, *Chairman*

Feb. 16, 1938

DR. WILLIAM HEWSON, *Clerk*

DR. GEORGE L. WHELAN, *Recorder*

SULFANILAMIDE IN THE TREATMENT OF EXPERIMENTAL STREPTOCOCCIC AND PNEUMOCOCCIC MENINGITIS. DR. JOHN A. KOLMER, WITH THE ASSISTANCE OF ANNA M. RULE and MARY L. WERNER.

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SYMPOSIUM ON NEW THERAPEUTIC AGENTS AS APPLIED TO OTOLARYNGOLOGIC PRACTICE. DR. JAMES A. BABBITT.

I have selected ten important recent additions to the therapeutic armamentarium of the otolaryngologist, giving a brief review of results reported in the literature and some of my own experiences with their use. Here, as in other fields of medicine where infection plays a major part, sulfanilamide dominates the scene. Its otolaryngologic significance is manifested chiefly in the treatment of streptococcic and pneumococcic invasion of the tympanic, the mastoid, the sinal and the oropharyngeal area.

Systemic shock or lowered resistance may serve to light up latent foci, and as the upper part of the respiratory tract and the otologic tract are numbered among the chief highways to the meninges, the indications for sulfanilamide are evident. A prophylactic application has been suggested. I have found that the periodic reaction after recovery from major streptococcic infection may be controlled by two or three days' administration of four 5 grain (0.32 Gm.) tablets daily. In major crises following operation, life may be saved by prompt administration of sulfanilamide. Not infrequently in cases in which there are obvious surgical indications cure without intervention may follow well directed treatment with sulfanilamide.

It is important, too, that the otolaryngologist be aware of the danger signals of intoxication by sulfanilamide. Among the earlier signs, which disappear rapidly, may be mentioned reddening of the mucous membranes and the conjunctivas, a maculopapular cutaneous eruption, cyanosis of the lips, nausea, tinnitus and vertigo. The ultimate effects of overdose may be sulfhemoglobinemia and methemoglobinemia, or even agranulocytic angina. As a safeguard, a blood count should be made every other day, and when the leukocyte count shows a material drop the drug should be withheld until it returns to normal. The dose depends on the severity of the infection, the age of the patient and the duration of the disease. For adults, tablets may be administered every six hours to an average of 60 grains (3.88 Gm.) for the first day, 40 grains (2.59 Gm.) for two or three days and from 10 to 20 grains (0.65 to 1.29 Gm.) for two or three days more. Large doses have been given to children without harmful effects. If methemoglobinemia should develop, oxygen should be administered, and in case of sulfhemoglobinemia, prompt blood transfusion is recommended.

Ephedrine has been found beneficial in the treatment of asthma and, in some cases, of hay fever and of urticaria. I have found that its internal administration will afford striking release of the nasal passages without significant toxic effect. Topically, of course, it is used for shrinking the nasal passages and aiding sinal drainage. The aqueous solutions are most effective and have little toxic effect. As regards ciliary influence, ephedrine seems to be the least harmful of the vasoconstrictors and does no such damage to the tissues as that observed after the use of epinephrine. Ephetonin may prove effective in cases in which both epinephrine and ephedrine fail. Among the newer ephedrine-like substances used for topical application to the nasal mucosa, tetrandine methiodide, hordenine methiodide, benzyldimethylene methiodide and betaphenylethylamine all show experimental evidence that they irritate the ciliated epithelium.

In the treatment of headache of obscure origin a combination of epinephrine, cocaine and antipyrine is recommended, while in some cases borderline idiopathic migraine, especially of the red type, responds to administration of this preparation and of some alkaline, bromide and ergot preparations.

Few antiseptic germicidal solutions have met with as much favor as metaphen. Used in 1 : 5,000 solution in the oropharynx, in solutions as strong as 1 : 500 applied locally in an infected middle ear and in combination with ephedrine in a watery shrinking spray for the nose, it has proved effective. Although without favorable results in cases of experimental septicemia due to pneumococcus or to Streptococcus haemolyticus, it has a high bacteriostatic action and a relatively low toxicity and is therefore, according to R. G. Douglas and K. E. Birkhaug, deserving of further clinical study. Reports from dentists have given an unfavorable impression of the use of weak solutions of metaphen on organisms in the mouth. I agree with other writers that the preparation has not replaced iodine.

Interesting results have been reported in the treatment of tinnitus and deafness in association with otosclerosis and of catarrhal deafness with injections of thyroxin into the middle ear, a treatment based on the passive congestion produced by this drug. Some results have been encouraging; others have not. In my own experience in 25 or 30 cases I have been disappointed, although I admit that this may have been due in part to the fact that the full series of six injections was not given in all cases. For anesthesia of the middle ear prior to injection of the thyroxin I have secured satisfactory results by application on a cone of cotton of a preparation containing oil of cloves, phenol, menthol, ethyl aminobenzoate and 22 per cent alcohol, followed by the use of 10 per cent procaine hydrochloride.

For relieving pain in the tonsillar fossae after tonsillectomy I recommend substitution of ethyl aminobenzoate for acetylsalicylic acid, which I believe retards healing. Insulin has been applied locally to stimulate granulation after tonsillectomy.

To check the pathologic crusting of the atrophic nose, intramuscular injections of an estrogenic substance in oil may be tried. Local application of estrogen is also recommended. I have made use of estradiol benzoate for this purpose.

In the treatment of subacute and chronic laryngitis nothing has given better results than mono-*p*-chlorophenol, suggested by Dr. Chevalier Jackson. It is dropped with a curved laryngeal syringe on the phonating cords.

Trichloroacetic acid in 25 per cent strength is recommended for control of septal hemorrhage without deep excoriation and as an aid to 10 per cent neoarsphenamine in antagonizing Vincent's angina.

Vitamins B and G have been tried in the treatment of varying degrees of both progressive adhesive and neural deafness, with one or two startling and several moderately pleasing results.

COMMENTS ON SOME OF THE RELATIVELY NEW DRUGS. DR. WILLIAM EGBERT ROBERTSON.

A slight change in the position of a radical on a nucleus may result in a material chemical and physiologic change in a product, as is true, for instance, of benzedrine, ephedrine, epinephrine and neosynephrine hydrochloride, which are all phenylalkylamine derivatives. Ephedrine is an alkaloid and epinephrine a biologic derivative. In the synthetic production of drugs, the drug is as efficient as the natural product if levorotatory, is inert if dextrorotatory and has about half the value of the natural product if optically a racemic compound. All four drugs mentioned possess the property of contracting the blood vessels when applied locally. They may therefore be used in combination with local anesthetics to prolong the effect of the anesthetic and retard absorption. In their other properties, such as their effect on blood pressure, on cardiac rate, on bronchial spasm and on the sugar content of the blood, these drugs differ, having either opposite effects or effects of varying degree. Their effect on the body, the mind and the sympathetic nervous system of different persons varies.

The local anesthetics vary in toxicity when injected and in rapidity of action when applied locally.

The chemical properties of iodine include its relation to the fatty acids and its value in the treatment of various conditions of interest to the otolaryngologist, such as ozena; it may be used as an antiseptic, as an irritant (stimulating regeneration), in liquid form, as a dusting powder, in treatment of infection by Trichophyton and as a substitute for iodoform. Of the dusting powders, thymol iodide and vioform are the best known.

Recently a host of mercuric compounds have been introduced, including mercurochrome, with its dangerous reaction following intravenous administration, metaphen, merbaphen and salyrgan. Mercury in aqueous solution of merthiolate is not precipitated by the serum proteins. It is used in treatment of the nose and the ear in dilutions of 1:2,000 to 1:5,000.

Sulfanilamide belongs to the azo compounds, a nitrogen linkage group. It was chance that led to the discovery that products of this group are of value in the treatment of human streptococcic infections. Streptococcus viridans does not respond to drugs of this group. It was soon learned that the more complex azo compounds containing sulfonamide are reduced in the body to the simpler nonazo para-amino form, which can replace the azo sulfonamide forms with even greater clinical value and less collateral ill effect. During administration of sulfanilamide repeated blood counts are necessary, for anemia and granulocytopenia may be induced, the former as an early and the latter as a late effect. The possible development of sulfhemoglobinemia or methemoglobinemia makes it necessary to avoid the simultaneous administration of sulfanilamide and a sulfur compound, even magnesium sulfate. Hemolytic anemia may be foreshadowed by the finding of an increasing reticulocyte count. Erythema, urticaria, morbilliform eruption, photosensitiveness and acidosis have been reported. Hence sodium bicarbonate is frequently given with sulfanilamide to prevent acidosis. The total daily dose should not be more than 75 grains (5 Gm.), even for persons weighing over 50 Kg.

Book Reviews

The Basis of Tissue Evolution and Pathogenesis. By Albert A. Gray, M.D., F.R.S.E. Price, 7 s. 6 d. Glasgow: Jackson, Son & Co. (Booksellers) Ltd., 1937.

One cannot approach this work, published after Dr. Gray's death from somewhat incomplete manuscript and notes, without the respect due a brilliant author whose works on "The Ear and Its Diseases," "Otosclerosis" and "The Labyrinth of Animals," have secured international honor. While one may be somewhat skeptical of the ultimate success of his dictum on the treatment of tinnitus and otosclerosis with thyroxin, this scholarly otologist must command attention.

His hypothesis of the origin of tissue is based on the belief that change of environment causes injury and subsequent repair to a given tissue or structure and that a new type of tissue follows this process of repair. In discussing the developmental aspect of the evolution of tissue and pathogenesis, he is of the opinion that *induced variation*, change in tissue brought about by injury from change in environment, rather than spontaneous variation, an evolution due to an accumulation of chance variation or relation, is the true basis of the evolution of tissue. He assumes that pathologic processes are simply deviations from the normal course in the process of repair according to well known biologic laws. Dr. Gray illustrates the evolutional changes and comparative anatomy of the membranous labyrinth by admirable specimens and photographs.

The author concludes that inherited pathologic conditions are of two types: first, those in which the defect is primarily a structural one, present from birth, as in deaf-mutism, and, second, those in which the defect is in the nutritional vasomotor mechanism, appearing some time after the organ has begun to function normally, as illustrated in otosclerosis.

While this work may be impractical for use as a textbook, nevertheless, because of its deep and thoughtful biologic concept it belongs in every library of biologic research.

Directory of Otolaryngologic Societies *

FOREIGN

Collegium Oto-Rhino-Laryngologicum Amicitiæ Sacrum

President: Prof. H. Burger, Keizergracht 317 C, Amsterdam, Netherlands.
Secretary: Prof. Dr. C. E. Benjamins, Verlengde Heereweg 143, Groningen, Netherlands.

Sociedad Rioplatense de Oto-Rhino-Laringología (Argentine Section)

President: Dr. Raul Becco, B. Mitre 1690, Buenos Aires, Argentina.
Secretary: Dr. Juan Manuel Tato, Santa Fé 1171, Buenos Aires, Argentina.

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. Gordon B. New, Mayo Clinic, Rochester, Minn.
Secretary: Dr. Leroy A. Schall, 270 Commonwealth Ave., Boston.
Place: San Francisco. Time: June 13-17, 1938.

American Academy of Ophthalmology and Otolaryngology

President: Dr. Harry S. Gradle, 58 E. Washington St., Chicago.
Executive Secretary: Dr. William P. Wherry, 1500 Medical Arts Bldg., Omaha.
Place: Washington, D. C. Time: Oct. 9-14, 1938.

American Bronchoscopic Society

President: Dr. John D. Kernan Jr., 120 E. 75th St., New York.
Secretary: Dr. Lyman Richards, 319 Longwood Ave., Boston.

American Laryngological Association

President: Dr. George B. Wood, 504 Physicians' Bldg., Philadelphia.
Secretary: Dr. James A. Babbitt, 1912 Spruce St., Philadelphia.

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. Harold I. Lillie, Mayo Clinic, Rochester, Minn.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester, N. Y.

SECTIONS:

Eastern.—Chairman: Dr. Frank E. Kittredge, Masonic Temple, Nashua, N. H.
Southern.—Chairman: Dr. Francis E. LeJeune, Maison Blanche Bldg., New Orleans.
Middle.—Chairman: Dr. T. R. Gittins, Davidson Bldg., Sioux City, Iowa.
Western.—Chairman: Dr. Frederick G. Sprowl, Medical Arts Bldg., Spokane, Wash.

American Otological Society

President: Dr. Isidore Friesner, 36 E. 73d St., New York.
Secretary: Dr. Thomas J. Harris, 104 E. 40th St., New York.

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* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.